

Modern Refrigeration & Air Control

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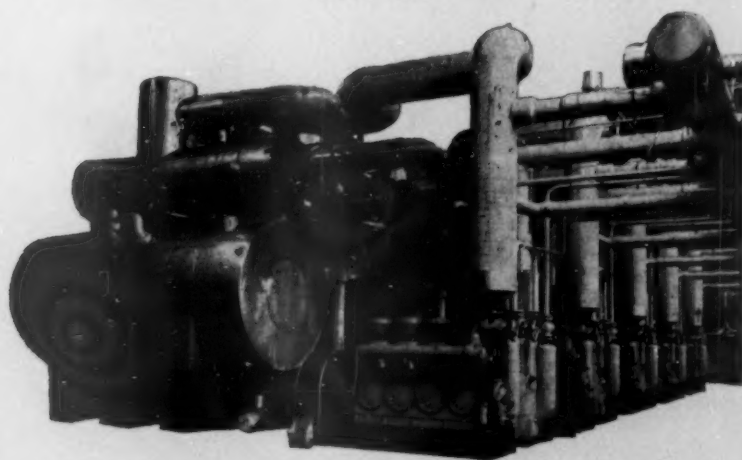
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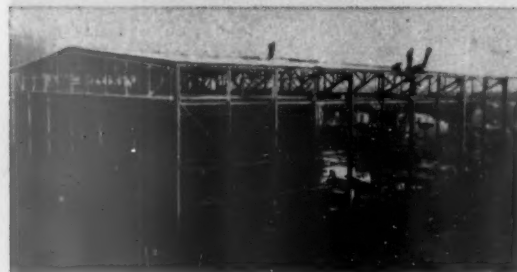
And here's why . . Smith's complete service cuts construction time and costs, and gives you a quicker return on your invested capital.



Rapid progress on a new store at Kingston-on-Hull for Messrs. Kingston Deep Sea Ltd.



Shown here is the recently completed store at Grimsby for Messrs. Chr. Salvesen & Co.



This photograph shows progress on a new 400,000 c. ft. store at Craigmillar, Edinburgh for Messrs. T. Walls & Sons (Ice Cream) Ltd.

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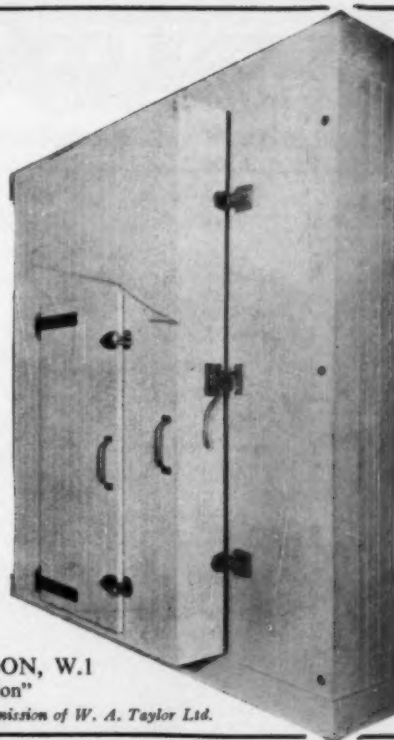
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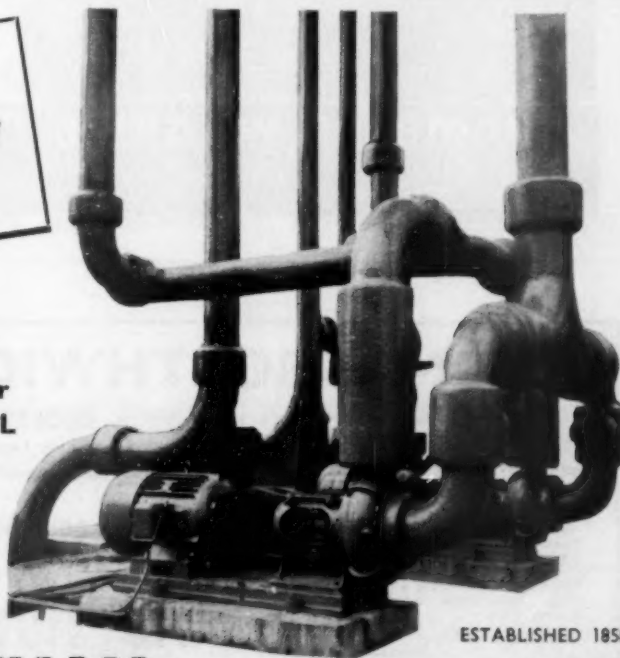
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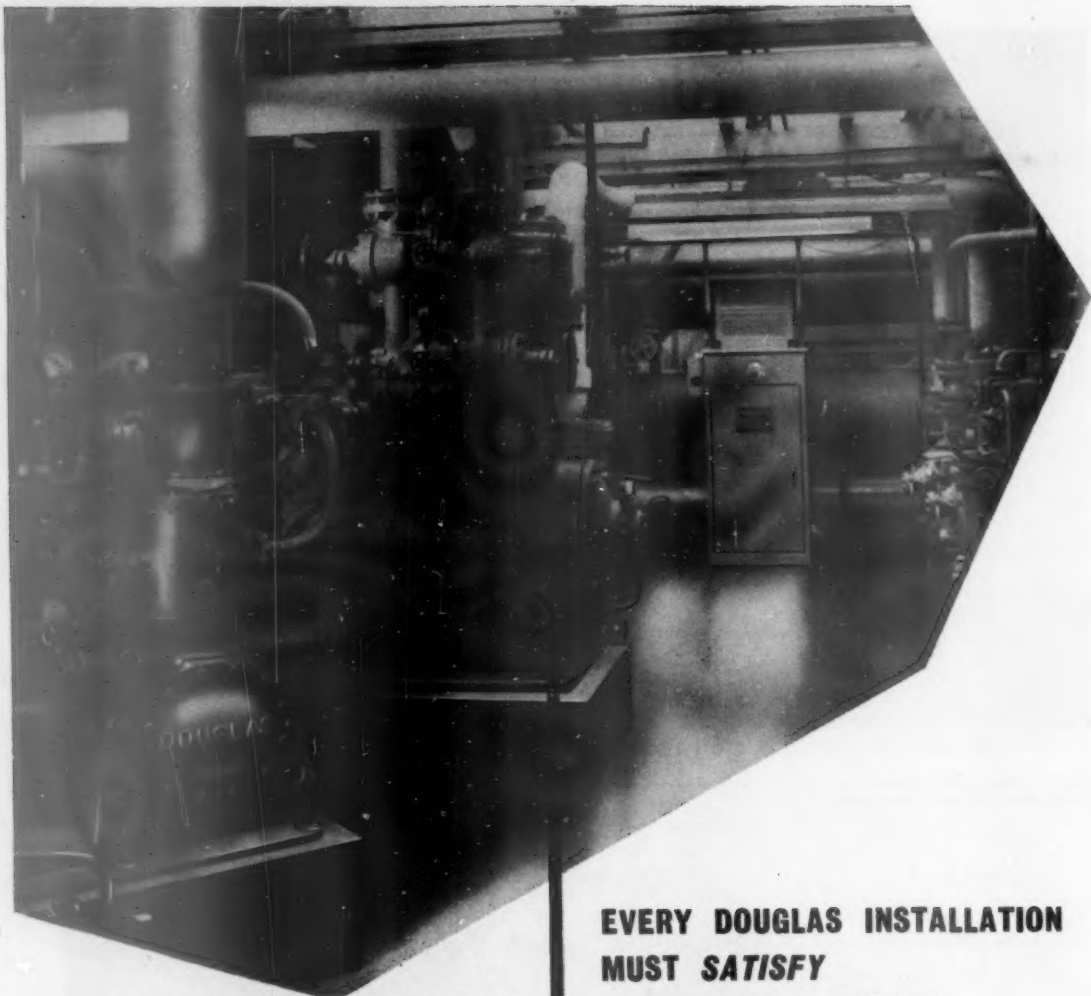
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The photograph shows two compressors out of six in a two-stage installation serving a number of ice-cream hardening tunnels. The premises are those of Messrs. Nielsons (Ice Cream & Frozen Foods) Ltd., by whose courtesy this photograph is reproduced.

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The rise of Lec Refrigeration Ltd. is a remarkable success story evolving from just another business 13 years ago to a major force in the refrigeration market. From the ultra-modern Lec factory at Bognor, Sussex, refrigerators now go to markets all over the world, including some of the most difficult for British exporters to penetrate.

The secret of Lec's success is contained in the slogan "Luxury Refrigeration at Lowest-ever Cost." Low costs are achieved by the greatest possible standardisation of components and by the latest engineering methods which cut manufacturing time to a minimum. On the other hand,

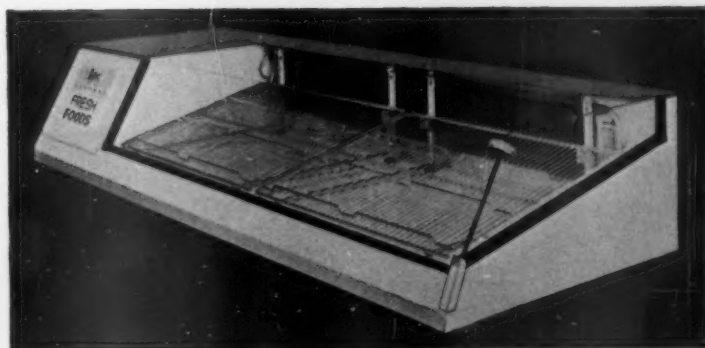
flexibility ensures that the latest improvements in refrigeration technique are immediately incorporated into all models. In this way the consumer gets an advanced refrigerator with all the latest features at the lowest possible cost.

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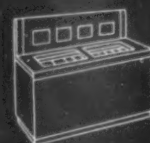
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'Darvic' is the registered trade mark for the rigid p.v.c. sheet made by I.C.I.

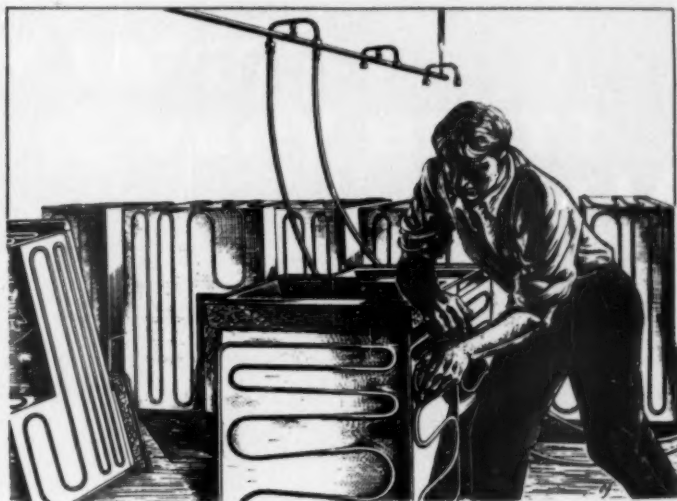
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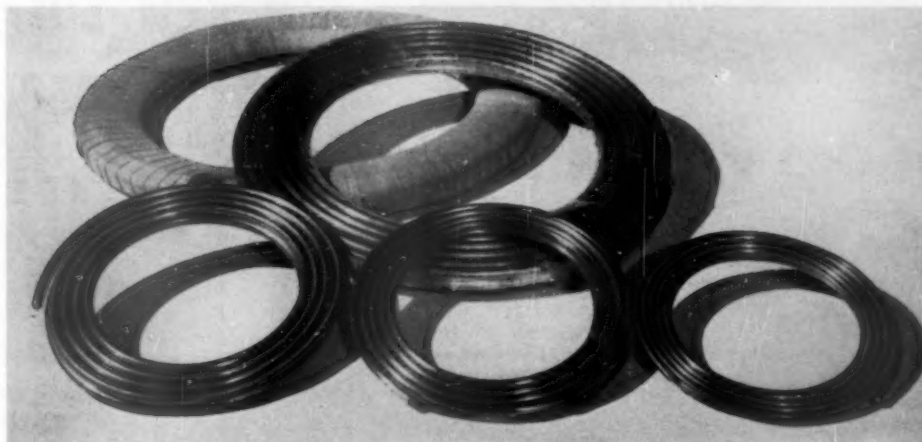
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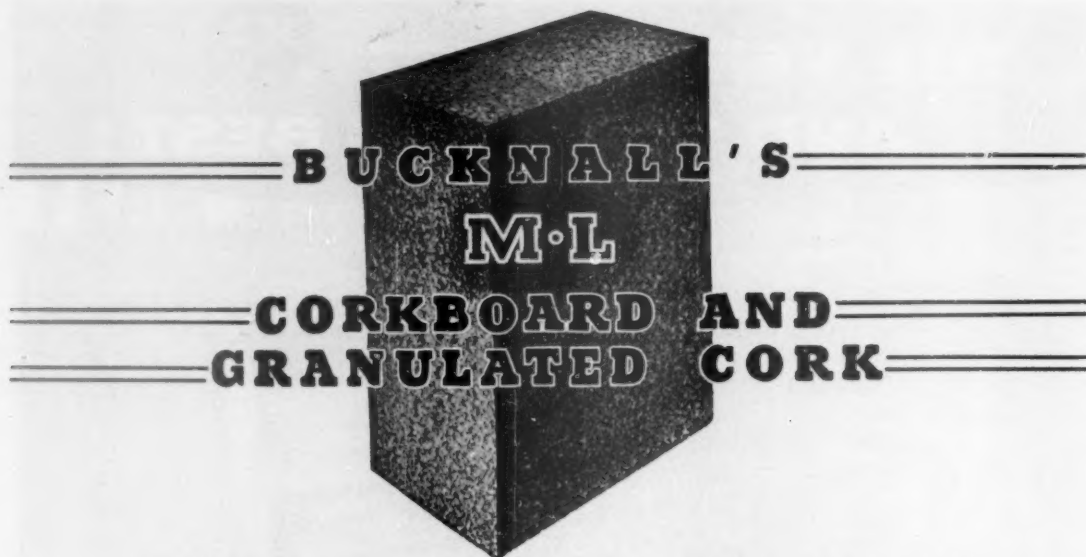
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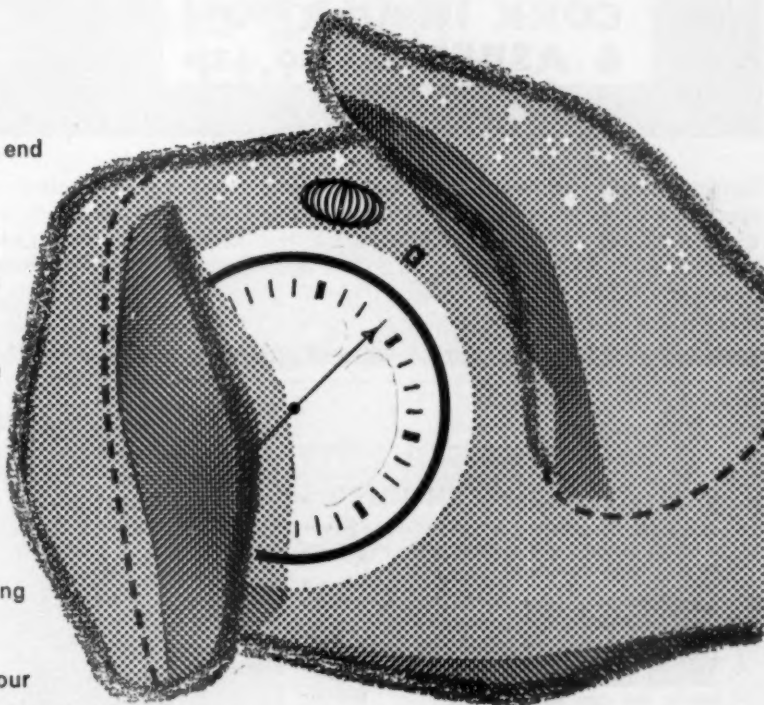
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MODERN REFRIGERATION February 1959

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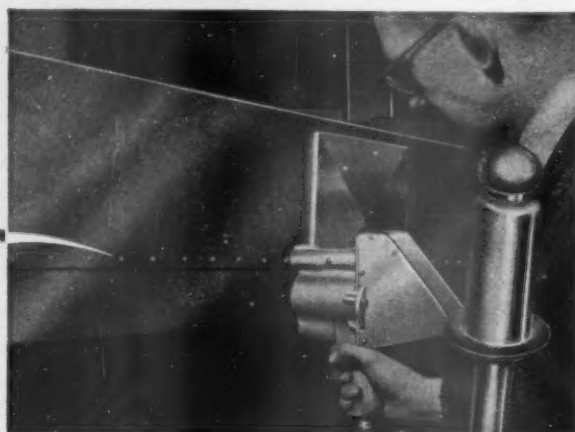
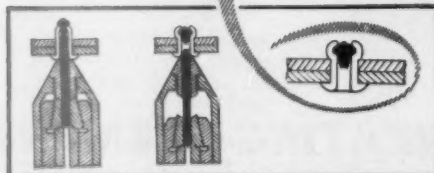
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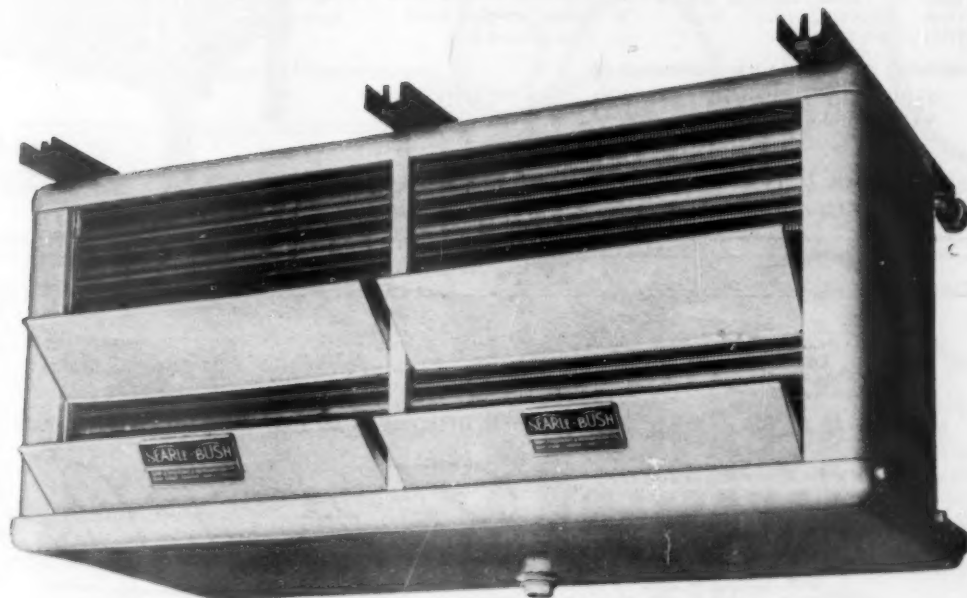
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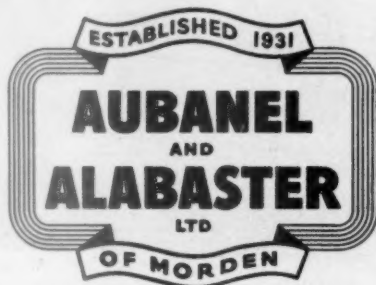
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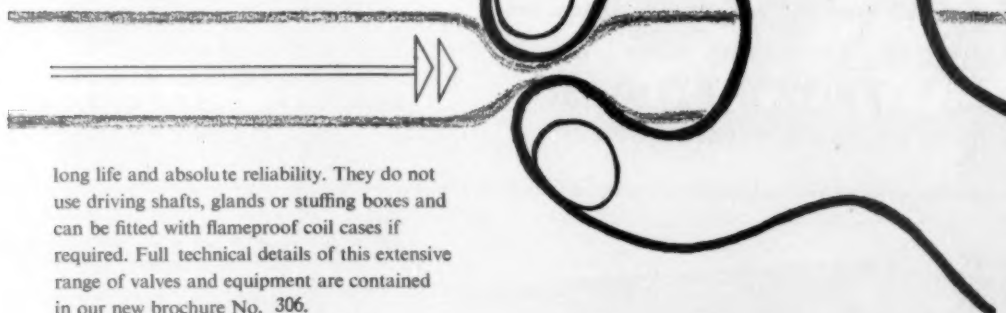
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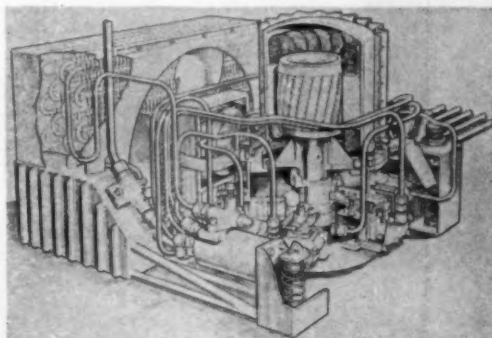
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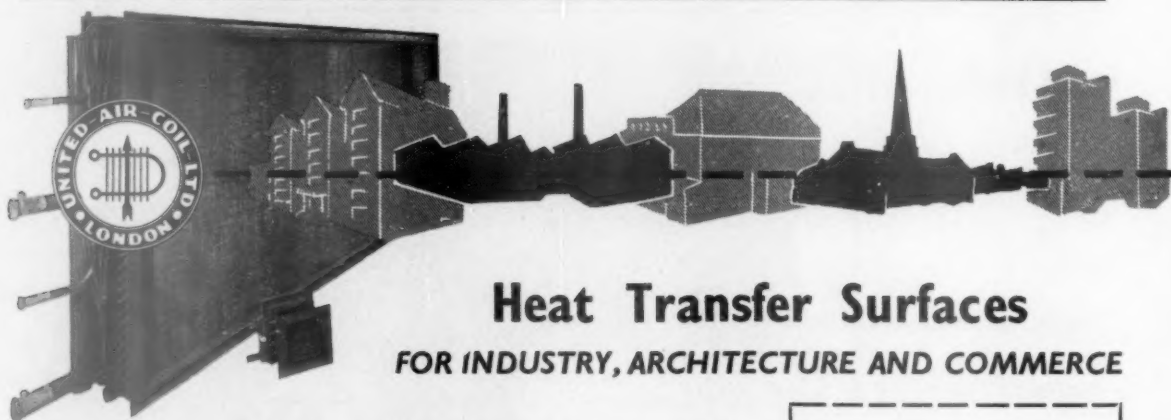
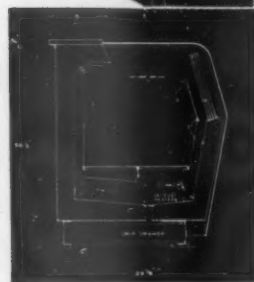
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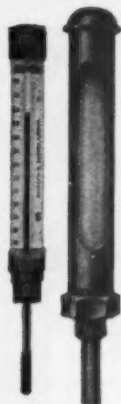
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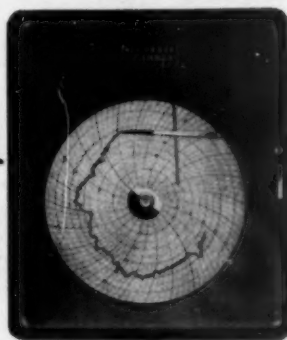
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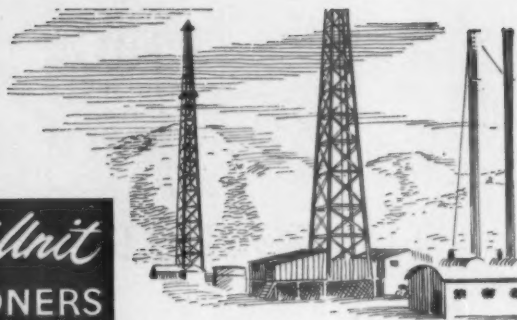
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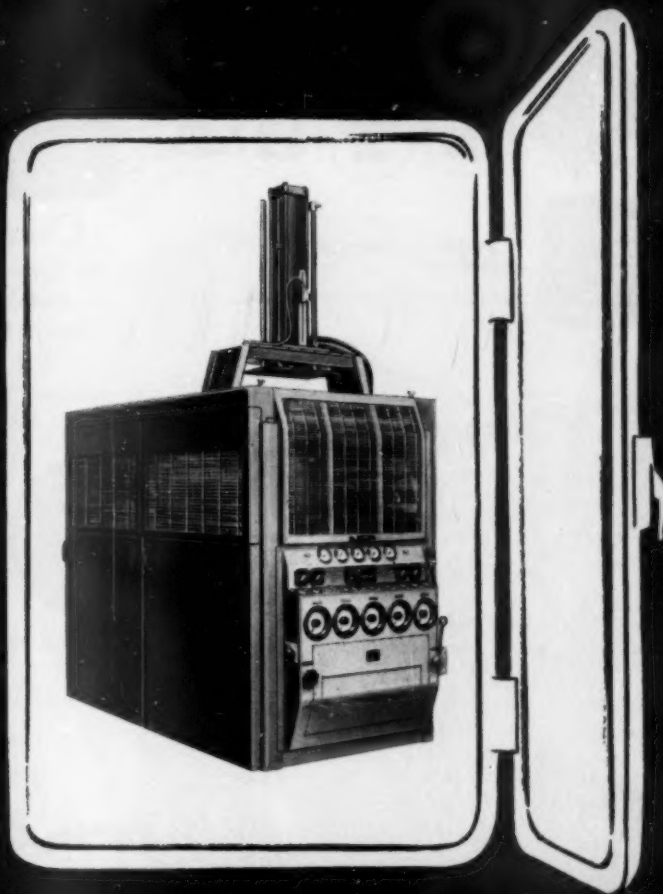
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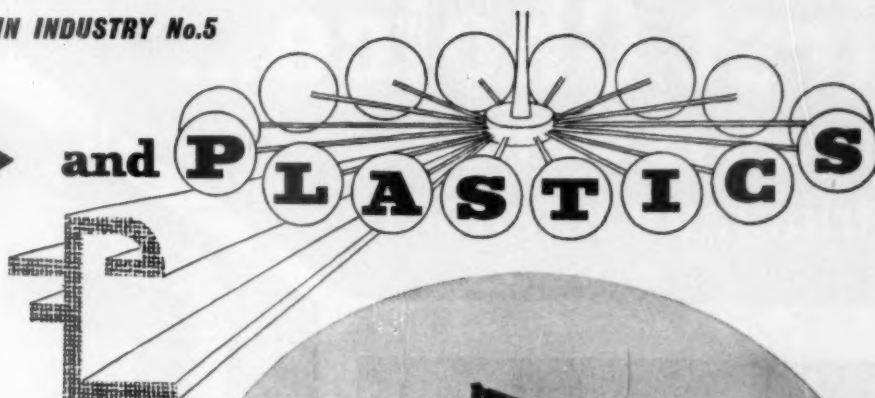
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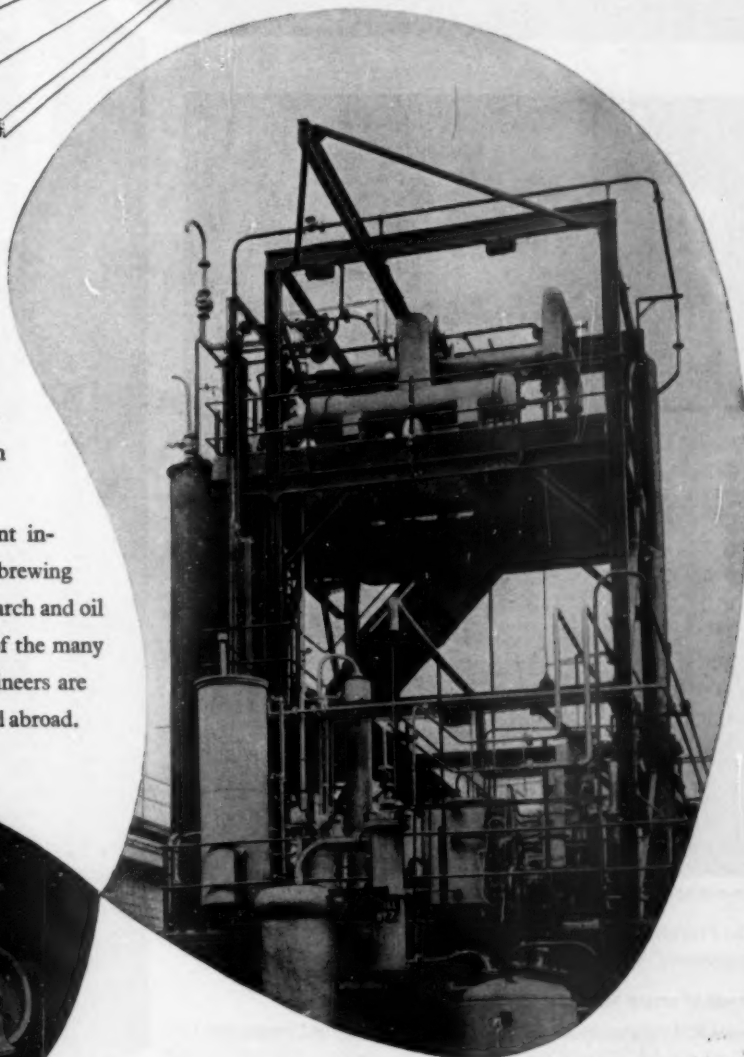
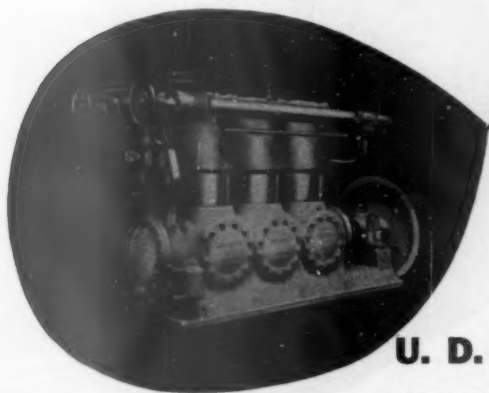
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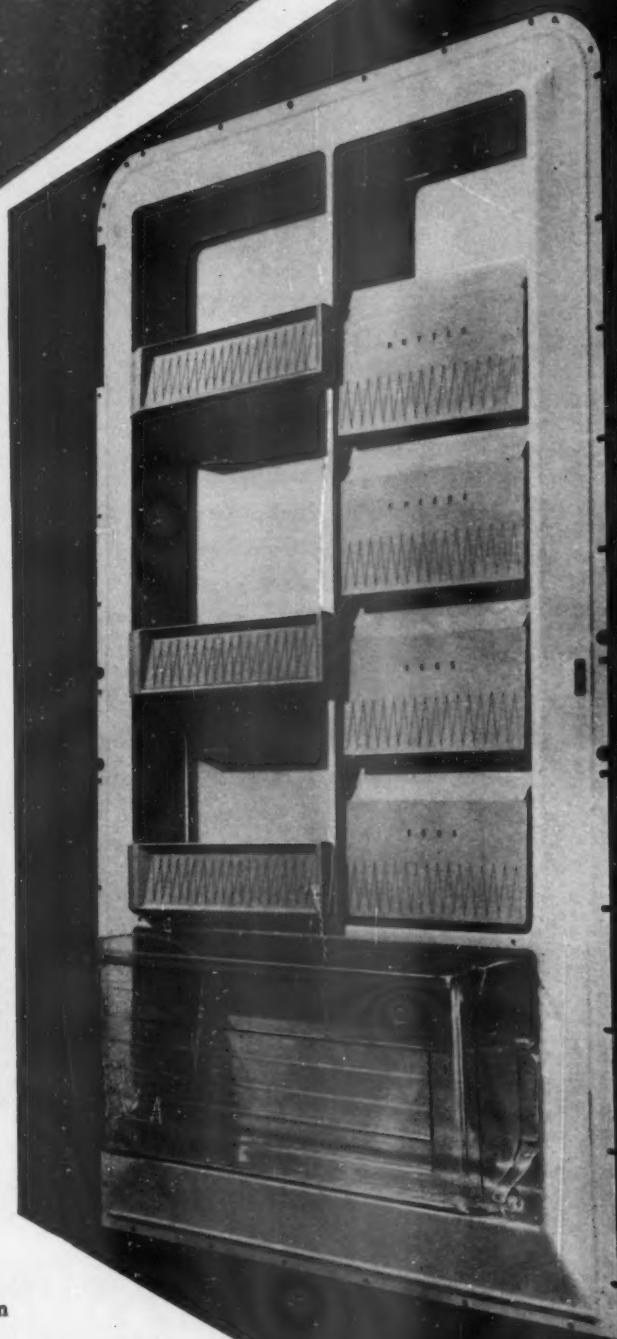
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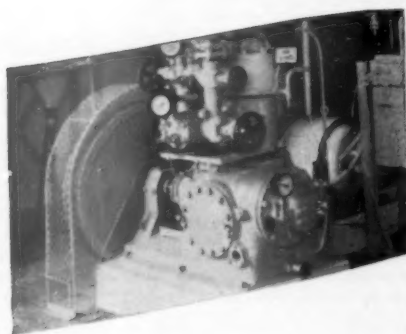


Incorporating
COLD STORAGE AND PRODUCE
REVIEW
and ICE AND COLD STORAGE

Established 1898

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MODERN REFRIGERATION *Overseas*

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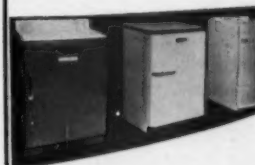
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February, 1959

Editorial

"Common Market" Matters The Argentine Outlook Vestey Centenary

- While the repercussions of the European "Common Market" are already being felt on industry generally this side of the Channel, British refrigeration makers have not been slow to exert their influence in Continental counsels.
- European manufacturers of refrigeration equipment have met for discussion on several occasions in the last four years as has been mentioned in these columns. At a meeting in Brussels during May, 1958, the discussion resulted in the formation of the Comité Européen des Constructeurs de Matériel Frigorifique (C.E.C.O.M.A.F.) the headquarters of which are in Paris. Membership is open only to the national trade association and was intended originally to be confined to the six countries of the European "common market." The council of the British Refrigeration Association, however, formed the view that the new association should be truly European, although it was recognized that manufacturers in the six common market countries would have problems which they might wish to discuss on their own. The U.K. delegation, Mr. J. A. Howie (managing director of The Lightfoot Refrigeration Company Ltd.), Mr. K. J. R. Cooke (director, Prestcold Division, The Pressed Steel Company Ltd.) and Mr. T. Whittaker (director of British Refrigeration Association) pressed this view, and at the next meeting in Milan during December, 1958, it was agreed to throw the membership open to all countries in O.E.E.C., the "common market" countries to have their own smaller group under the chairmanship of M. R. Malengret-Lebrun (Belgium), we learn from B.R.A. headquarters.
- While the constitution of the new association has been the chief item under regular discussion, the meetings have provided opportunities for general discussion and for arranging the interchange of experience and information. A technical committee has also been set up under the chairmanship of Dr. von Cube (Germany) grouping the delegations from Belgium, Denmark, France, Germany, Italy, Switzerland and the United Kingdom. This committee proposes to assist the work of the International Institute of Refrigeration and the International Standards Organization by ensuring that national delegations to each are aware of the point of view of the manufacturers.
- The annual statement of the chairman of the Houlder Line Limited—this year marks the diamond jubilee of the company—usually embodies a valuable review of the Argentine meat situation; this year's

report was no exception. "As shareholders will know," declared Mr. Walter C. Warwick, "an important part of our operations is the meat business from South America and in the past year shipments of meat from the Argentine have been fairly well maintained except in August and September when serious dislocation was experienced owing to widespread labour troubles. These resulted in serious disruption of the normal regular flow of chilled meat with considerable loss to all the shipowners engaged in this trade.

- "At the moment both political and economic uncertainties in the Argentine are disturbing factors," went on the Houlder chairman, "but on a long term view I feel no doubt that in the country's own interests the Argentine must maintain a high level of exports, including chilled meat, and in order to maintain fully our participation in this trade we have, as reported in my address last year, entered into a contract for the building of an additional fully refrigerated vessel to be named *Hardwicke Grange*. The cost of this ship is estimated at about £2,250,000 and by the time this fine ship comes into commission at the end of 1960 there is, I think, every hope that chilled meat shipments will be on a satisfactory level to enable this additional vessel to be regularly and profitably employed."
- Construction of Houlder Line's turbine refrigerator vessel *Royston Grange* is progressing satisfactorily and in the absence of any major labour troubles she should be ready for service next autumn.
- Mention of refrigerated shipping brings to mind the fact that the centenary of the birth of William, first Baron Vestey, fell upon January 21. The eldest of the six sons of a Liverpool merchant, Vestey had his course in life pretty clearly marked out for him. By the time he was 17 he had shown sufficient business sense for his father to send him out to the U.S.A. to effect the purchase of goods, and arrange for their conveyance to England. A near-millionaire at 30, William Vestey retired from business to build himself a fine house at Freshfield, near Southport. But leisure, however fortified by wealth, could not content so active a mind for long and, after a few years of inactivity, rumours of new inventions in the field of food preservation in Argentina drew him magnetically to that country.
- While in Argentina he became so stimulated by the prospects before him that he decided to try out in England some of the latest developments in the hygienic treatment of food which he had acquired in South America. So he went back to Liverpool where, with the help of his brother Edmund, he established the very first cold store to be introduced into England. The success of this innovation was so immediate that the Vesteys were encouraged to extend their pioneer work into London. And it was in these small beginnings that the world-wide organization of the Union Cold Storage Company found its birth.

● The thermo-electric effect is arousing great interest in all parts of the world. According to Mr. Viney Brown (*see* Thermo-Electricity comes of Age—*this issue*) the recent progress in all aspects of thermo-electricity may foreshadow a major industrial revolution. One of the predictions made in this article has already been fulfilled, by the American announcement of an atomic-powered thermo-electric generator. This device weighs only 5 lb. and will be used in space rockets. Over a period of 276 days, 1,450 lb. of ordinary batteries would be required to produce the same amount of power as this generator. Thermo-electric products, ranging from domestic refrigerators to dew-point hygrometers, are in quantity production in Russia, and judging by the feverish activity on both sides of the Atlantic, the western world is not very far behind.

ENHANCED STANDARD OF LIVING THROUGH INDUSTRIAL INSTRUMENTATION

SPEAKERS at the annual luncheon of B.I.M.C.A.M. (British Industrial Measuring & Control Apparatus Manufacturers' Association) in London last month were unanimous in emphasizing the importance of the British instrument industry to the future well-being of Great Britain and indeed of every country throughout the world.

Sir Ewart Smith, M.A., F.R.S., a deputy chairman of Imperial Chemical Industries Ltd., proposing the health of the Association, spoke of the growing importance of instrumentation in the process industries. He pointed out how in the old days industrial plants were designed first and instrumentation was added as something of an afterthought. To-day, he said, instrumentation is an integral part of the initial design. He went on to recommend an ever-closer association between the instrument manufacturer and the instrument user so that an even greater understanding of each other's problems might be achieved.

Sir Ewart Smith and the other speakers were introduced by Mr. L. S. Yoxall, president of B.I.M.C.A.M., who also proposed that toast to the guests.

Mr. D. B. Pinkney, chairman of B.I.M.C.A.M., replied to Sir Ewart Smith and in acknowledging the thanks of the instrument manufacturers to the plant engineers he pointed out that what instrument manufacturers were really selling was an engineering service. He outlined the aims of B.I.M.C.A.M. which, he said, were, *inter alia*, to maintain the highest ethical standards; to speak with a united voice for the industry and to provide a means for instrument manufacturers to meet and make friends with each other and their customers. He mentioned that the Association now represents some 42 companies with a combined annual turnover of more than £25,000,000.

Responding for the guests, Mr. H. Landeweer, head of the instrumentation department, Royal Dutch/Shell Group, The Hague, called for a greater degree of free competition unhampered by national frontiers.

"It is my opinion," he said, "that it is necessary to develop large scale co-operation between manufacturers, thus enabling them to co-ordinate their efforts in development and standardization. Moreover, it is not a stringent law that only industries of the same nations should work together. Industries of different countries may work together and by making use of their different national traits better opportunities and results will be attained."

Mr. Landeweer went on to instance the great advances now being made in instrumentation design and manufacture in such countries as Germany and Japan. He emphasized that in his opinion the foremost requirement in instrumentation is quality. He concluded by reminding the members of B.I.M.C.A.M. that industrial instrumentation not only increases the efficiency

and profit making capacity of the process industries, but in addition, basically assists in raising the standards of living on a national and world-wide scale.

● The City and Guilds of London Institute is now operating from their new headquarters at 76 Portland Place, London, W.1., instead of from the six scattered positions previously occupied. The retention of certain office accommodation in the city and the continued privilege of using livery halls for the meetings of senior committees will preserve physical contact with traditional friends in the city and reinforce the intangible bonds which tie the Institute to its birth-place. Already the plans for the expansion of technical education set forth in the Government's white paper on technical education of February, 1956, are resulting in the provision of new technical colleges and the extension of old ones, with the effect that many more young people will be able to profit from further education.

Correspondence

To the Editor,
MODERN REFRIGERATION,
London, S.E.1.

Sir,—Though I know that it is not possible for you to answer for refrigeration manufacturers, perhaps with your knowledge of the industry, it will be possible for you to comment on a quick-freezing practice which seems to be growing in the oven-ready poultry producing trade.

The practice to which I refer is the (for want of a better name) "partly-partly" method, in which the birds to be quick-frozen are placed in a quick-freezer for a short period of time, and are then removed to a low-temperature cold store where the remaining heat is released at a slower rate. Is it assumed that when the birds are taken from the quick-freezer the critical period has been passed, and that it does not matter, to an hour or two, how long it takes to remove the remaining heat?

If this is so, then it would seem to be a backward step in quick-freezing, and makes one wonder how long will it be before a set of standards is laid down, not only to safeguard the consumer of so-called quick-frozen products, but also the buyer of small quick-freezing plant who is usually entirely in the hands of the salesman, each one of whom has a variation on the main theme.

As some of this country's largest manufacturers are selling this type of equipment, I feel that there must be a simple answer, and I shall be pleased to have your comments.

Yours, etc.,

R. E. ADAMS,

126, Lichfield Road,
Great Yarmouth.

This matter will be discussed next month.—Ed.

The firm of Azienda Italiana Termomescolatori di Via Goffredo Mameli 1, Genoa, have advised the British consulate-general at Milan that they are desirous of securing the representation for Italy of United Kingdom manufacturers of refrigerating and heating plant, particularly for use in the manufacture of ice cream or for the treatment of milk, machinery used in the food industry, for example, mixing plant, etc. The Italian firm is an individual concern established in November 1956 to engage in the import and sales representation of machines and plant for the milk, ice cream, confectionery and foodstuffs industries.

NEWS OF THE MONTH

Refrigeration and A-c. Exports.—During December, 1958, air-conditioning and refrigerating machinery (commercial and industrial sizes) to the value of £654,970 weighing 1,052 tons, was exported from the United Kingdom. Comparable figures for December, 1957 were 1,466 tons, worth £990,130.

Exports' Analysis.—Of the 1,052 tons of air-conditioning and refrigerating plant worth £654,970 exported by Great Britain in December, 1958—quoted in the preceding paragraph—55 tons went to the Union of South Africa, 61 tons to India, 83 tons to Australia, 29 tons to New Zealand, 32 tons to Canada, 226 tons to "other Commonwealth countries," 19 tons to Eire, 13 tons to Sweden, 252 tons to Western Germany, 31 tons to the Netherlands, 18 tons to Belgium, 24 tons to France, 18 tons to Italy, and 191 tons to "other foreign countries".

Refrigeration Plant Classified.—Of the total exports of air-conditioning and refrigerating machinery during December, 1958, quoted in the first paragraph commercial refrigerators accounted for 326 tons, worth £173,838, industrial plant and equipment for 134 tons worth £76,413, and parts for all non-automatic refrigerating machinery, for 333 tons, worth £226,312.

Exports of Small Refrigerators.—During December, 1958, 990 tons of complete refrigerators (including complete mechanical units) of a storage capacity not exceeding 12 c.ft. were sent overseas from Great Britain. These exports were worth £685,026. The 990 tons comprised 68 tons to the Union of South Africa, 24 tons to Rhodesia and Nyasaland, 3 tons to India, 50 tons to New Zealand, 467 tons to "Other Commonwealth countries," 2 tons to Sweden, 2 tons to Western Germany, 2 tons to the Netherlands, 13 tons to Belgium, 14 tons to Italy, and 345 tons to "other foreign countries".

Capetown Pre-cooling Facilities.—The new Capetown harbour pre-cooling installation, costing £2,500,000 and the most modern of its kind in the world, received its first consignment of deciduous fruit last month. Nearly a year ago, the biggest fire in the port's history destroyed the main pre-cooling installation in 1½ hours. The erection of the new shed was a race against time. Artisans worked 24 hours a day and were paid incentive money to get the new shed ready in time for the current export season. On the 21st ultimo, 22 loads containing 300 cubic tons of export fruit (pears, peaches, plums and grapes) were delivered at the shed, 5,600 tons of fruit for Southampton, and 2,400 tons for Gothenburg (Sweden) have been loaded into the *Roxburgh*

Castle. But the first ship to receive a consignment from the new shed was the *Oranjefontein*, loading a few 100 tons for Antwerp. Mr. B. J. Schoeman, Minister of Transport, opened the shed officially on February 5.

11th Power Convention.—"Electricity and its contribution to the standard of living" is to be the theme of the 11th British Electrical Power Convention which is to be held in Torquay from June 1 to 5, under the presidency of Mr. C. R. King, C.B.E., COMF.I.E.E., M.INST.F., deputy chairman, Central Electricity Generating Board. As in former years there will be an electrical exhibition associated with the convention. Although the exhibition will be officially opened by the president on the evening of Monday, June 1, it will be open to delegates all day. The convention sessions will be held in the Pavilion and will open on the morning of Tuesday, June 2, when Mr. King will give his presidential address. According to the preliminary programme a paper on "Progress on the first nuclear power stations—Bradwell, Berkeley, Hinkley Point, Hunterston," will be given on Tuesday morning by Mr. F. S. Brown B.SC. (HONS.), M.I.MECH.E., M.I.E.E., member of the Central Electricity Generating Board, and Mr. J. Henderson, M.C., B.SC., A.R.T.C., M.I.E.E., chief engineer, South of Scotland Electricity Board. On Wednesday morning Mr. A. N. Irens (M.SC. (ENG.), M.I.E.E., chairman, South Western Electricity Board, will present a paper on the subject of industrial, commercial and domestic electrical progress.

International Plastics Exhibition.—In order to keep abreast of a continuing demand for space in the forthcoming International Plastics Exhibition (Grand and National Halls, Olympia, London, June 17 to 27), the organizers have decided to extend the machinery section into the Empire Hall. This will increase the total occupied area to over 270,000 sq. ft. Fully international for the first time since its inception in 1951, the exhibition will put on show plastics materials, machinery and finished products from 15 countries. Britain's own vast plastics industry, third largest in the world, will be represented by more than 200 firms showing the latest achievements in the chemistry, mechanics and merchandising of plastics. One large British organization, the Commercial Plastics Group of Companies, has booked the entire end section of the first floor area in the Grand Hall. Their display, with a frontage of 160 ft., will show p.v.c. film and sheet, polythene, polystyrene, and an extensive range of products manufactured from these materials. Attendance at the International Plastics Exhibition is expected to exceed 90,000 persons.

New Private Cold Store Caters also for Public Business

RECENT articles in "M.R." on new cold storage construction have reflected the steady increase in holding capacity that has taken place throughout the country since the war; the port of Grimsby has attracted many operators in this field, particularly in latter months. The latest addition to the fish trade's stores is a good example of a building constructed to meet the needs of a food processor who wishes to cater also for public business.

Such an undertaking is Chr. Salvesen & Co.'s Levington Street Cold Store. This low temperature store, incorporating all the latest features of cold store construction, has been built and equipped at a cost of over £200,000. It is of approximately 3,000 tons capacity and built on a 3,000 sq. yd. site, bounded by Levington Street, Riby Street and Humber Street.

The expanding requirements for public cold storage space and the company's own envisaged increased production, led to the decision to build being made. For economic reasons the store has been built with far greater capacity than the owners themselves require and an extensive public cold storage service is offered. Salvesen's, being themselves substantial users of public cold storage, have been alive to the needs of the customer and have spared no cost in attempting to offer a service second to none.

The Store

The store consists of two large chambers and a small sampling or breakdown room. Each room is steel framed and has a clear span with no internal pillars or beams. The floors are suspended on brick sleeper walls to a height of 4 ft. from ground level. This method of construction allows free passage of air under the cold room floors eliminating the danger of frost-heave. No electric mat is thus required.

Insulation is 9 in. all round, being made up of expanded polystyrene and cork, all vapour sealed. The floor insulation, which is all cork, carries 4 in. of reinforced granolithic concrete as a working surface. Outside of the insulation are air spaces, fire proof asbestos sheeting and aluminium cladding. The roof is of asbestos.

Refrigeration

Both of the main chambers can be held independently at any temperature between +15° F. or -20° F.

Refrigeration is by liquid ammonia circulation through ceiling and wall coils. These coils are divided into a number of independent circuits to facilitate hot gas defrosting. Three compressors are installed,

each driven by a 120 horse power electric motor. In normal circumstances one compressor alone can cope with maintaining both rooms at -20° F. and two can easily cover requirements under the most adverse storage conditions. The third compressor is a standby. The condensers, three of the forced draught type, are situated on the engine room roof and again one of these is spare to the requirement under most adverse conditions.

All refrigeration is automatically controlled to maintain rooms at constant temperature.

Loading Facilities

The large loading platform at tailboard height has room for six lorries to be dealt with simultaneously. The whole loading dock is roofed and totally enclosed.

Goods are unloaded from lorries by means of roller conveyers and, where possible, stacked on to pallets. Fork lift trucks carry loaded pallets away to the cold chambers where reach trucks are employed for stacking. Deliveries are made by the reverse process.

All metal pillar pallets are used extensively to eliminate crushing of weak or fragile packages. Sufficient gangways are maintained in the store to ensure that customers' goods, whether in large or small quantities, are always readily accessible.

An automatic weight recording scale is available for weighing goods in or out of store.

Administration

The on-the-spot running of the store is in the hands of the superintendent, Mr. F. Allen, who has had a wealth of cold storage experience, while the administration and management is carried out at Salvesen's branch office, Marshall's Wharf, Victoria Street, Grimsby, under the direction of the branch manager, Mr. E. Sealey. Salvesen's aim is to provide a quick and efficient service at competitive rates.

The main contractors and suppliers are:—

Main building contractor—F. A. Would Ltd., Grimsby.

Superstructure and insulation—Smiths Insulations Ltd., Burton-on-Trent.

Refrigeration—J. & E. Hall Ltd., Dartford.

Electrical Installation—Harry Carr Ltd., Grimsby.

Fork truck suppliers—Conveyancer Fork Trucks Ltd., Warrington. Lansing Bagnall Ltd., Basingstoke.

Pallet suppliers—J. Ogle & Sons Ltd., Grimsby. Tubewrights Ltd., Liverpool.

Thermo - Electricity Comes of Age

By R. VINEY BROWN
University College, London



The Author.

SUMMARY

This paper reviews the present situation in applied thermo-electricity, and attempts to predict what the future may hold. The basic principles of thermo-electric cooling, heating and generation are described and many practical applications discussed.

Historical Survey

OUR story begins in the year 1822 when Seebeck submitted a report to the Prussian Academy of Sciences. He had discovered that thermo-electric currents arise in a closed circuit constructed from different materials, when a temperature difference is maintained between the junctions (fig. 1). If he had fabricated a thermo-couple using the best materials available at that time, he could have converted heat into electrical energy with an efficiency of 3 per cent. This sounds poor by modern standards but compares favourably with steam engines of Seebeck's era.

The next milestone was reached in 1834, when a French watchmaker called Peltier, observed that the passage of a direct current through two dissimilar metals caused heat to be absorbed at one junction and evolved at the other (fig. 2).

During the last century, physicists were busy unravelling the mysteries of electro-magnetism and electrical engineers were fully occupied in the development of rotating machinery. Thermo-electricity was allowed to slip into oblivion. With the advent of thermodynamics, the direct conversion of thermal and electrical energy was recognized as an attractive possibility.

Let us now consider the fundamental principles of the thermo-electric effect so that we may understand how scientists set about improving the efficiency of the conversion process.

Thermo-Electric Cooling

Utilization of the Peltier effect for refrigeration may be considered as the substitution of electron gas in place of the more conventional refrigerants such as ammonia and "Freon." The principle of Peltier cooling is illustrated by fig. 1b. The two dissimilar thermo-electric materials are denoted by n and p.

When the current passes from n type to p type material, heat is absorbed, thereby increasing the energy of the electrons and causing the interface between the thermo-elements to be cooled. This excess energy is evolved as heat at the second interface when the current flows from p to n type material.

In practical devices it is generally necessary to use a large number of thermo-elements in order to produce a substantial cooling effect. A typical assembly is shown in fig. 3. In this arrangement the cold surfaces are placed on one side of the system and the hot surfaces on the other side.

The "thermo-electric power" of a material is a measure of the magnitude of the Peltier effect in that material. By definition, n and p type materials have negative and positive thermo-electric powers, respectively. There are two heat losses which reduce the heat absorbed by the Peltier effect. One is the loss by thermal conduction through the thermo-elements, and the other is the Joule heat loss due to the electrical resistance of the thermo-elements.

A "figure of merit" for thermo-electric materials

may be defined as follows:—

$$Z = \frac{\alpha^2 \sigma}{\kappa}$$

where z = figure of merit,

α = Thermo-electric power,

σ = Electrical conductivity,

κ = Thermal conductivity.

The figure of merit is a convenient measure of the usefulness of a particular material for thermo-electric cooling applications. This definition of z applies to both n and p type materials.

It is apparent that we require materials with a high thermo-electric power and a high ratio of electrical to thermal conductivity. Until fairly recently the choice of thermo-electric materials was confined to metals. The results were not encouraging; in fact, a temperature difference of 10°C . is the largest so far reported for metallic thermo-elements.

The advent of semi-conductors opened the door to sensational advances. The thermo-electric powers exhibited by semi-conductors are some hundreds of times higher than those of metals. This factor more than compensates for the low ratio of electrical to thermal conductivity inherent in semi-conductors.

Materials with z values of the order 3×10^{-3} have been produced in Russia and elsewhere.

To achieve satisfactory results it is essential to prepare materials at least 99.99 per cent. pure.

Apparatus capable of producing high purity materials has been constructed by the author. It is intended to investigate some promising new compounds with a view to further improvement of "the figure of merit."

The coefficient of performance of a refrigerating device is defined as the ratio of the heat extracted to the electrical energy supplied. Fig. 4 shows the variation of c.o.p. with the operating temperature difference ΔT , i.e. (temperature difference between hot and cold junctions) for a range of z values. The graph also compares the efficiency of thermo-electric cooling with the more conventional methods.

An experimental device built by the author achieved a cold junction temperature of -15°C . under ambient conditions of $+20^\circ\text{C}$. Bismuth telluride thermo-elements were used in conjunction with a copper heat exchanger.

Details have been published for cooling devices which are more economical than absorption units and of comparable efficiency to small compression units. There are many highly desirable features of thermo-electric refrigeration, such as compactness, absence of moving parts, reliability and silence. At the present time the large scale use of thermo-

Fig. 1.

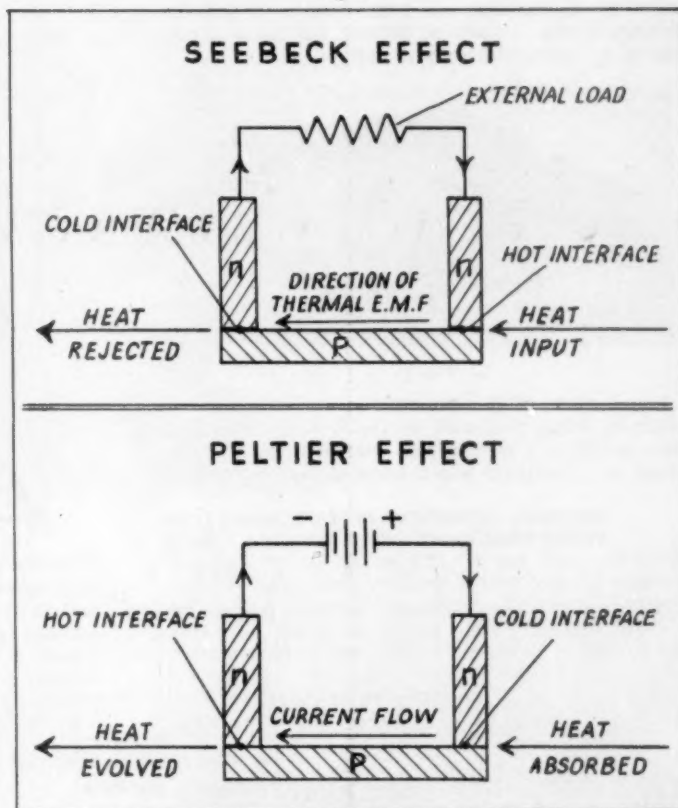


Fig. 2.

elements in consumer appliances is not an economic proposition. This is mainly due to a few production difficulties which remain to be solved. It is interesting to note, however, that the Russians have a medium-sized domestic refrigerator in limited production.

For the temperature control of small units with thermal loads of a few watts, thermo-electric cooling has no competition from mechanical refrigeration. There is considerable scope in specialized equipment for laboratory and medical use. Russian scientists have produced more than thirty useful devices of this type, several of which weigh only a few grammes and consume less than one watt.

In the large scale refrigerating and air-conditioning fields, power consumption is an important factor. If thermo-electric cooling is to compete successfully materials must be found with a figure of merit exceeding 4×10^{-3} .

Thermo-Electric Heating

The use of thermo-electric heating equipment offers outstanding possibilities. This application utilizes the well-known heat pump principle in which heat is extracted from the outside atmosphere and

delivered to the room together with the heat produced by the current. In some cases it is possible to provide one κ watt. of heating for the expenditure of $\frac{1}{2} \kappa$ watt. of electrical energy.

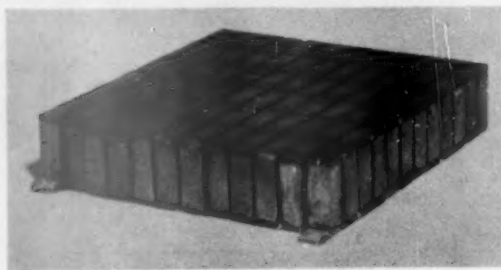


Fig. 3.

Use is made of this principle in a "hostess cart" which is being produced in the U.S.A. The heat extracted from a refrigerated compartment is transferred to a hot-plate which keeps dishes warm.

MAXIMUM COEFFICIENT OF PERFORMANCE (COP)
VERSUS TEMPERATURE DIFFERENCE FOR $T_c = 300^\circ\text{K}$

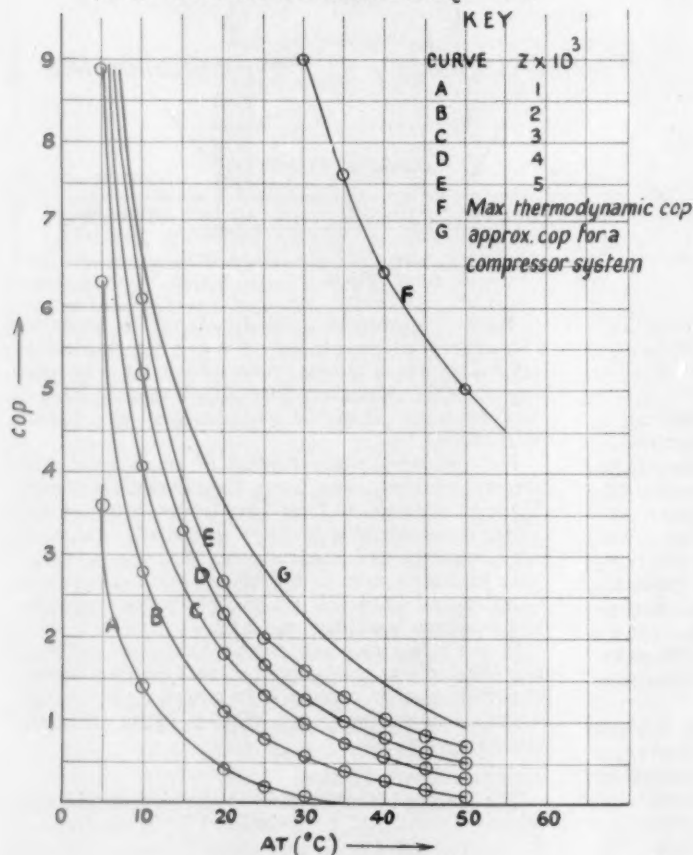


Fig. 4.

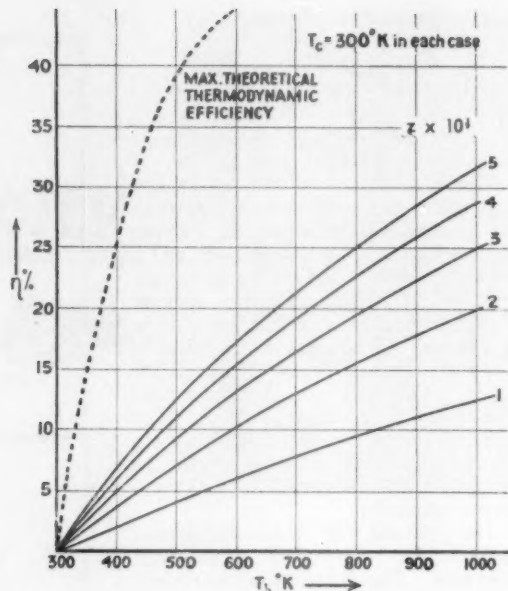


Fig. 5.

Thermo-Electric Generation

The direct conversion of heat into electrical energy may be accomplished by equipment based on the Seebeck effect. The physical configuration is shown in fig. 1a.

The selection of materials is governed by the same factors as for thermo-electric cooling. By a similar argument it may be shown that we require materials which exhibit a high value of z . Fig. 5 shows how the efficiency of generation $\eta\%$ varies with hot junction temperature T_h for various values of z . The voltage generated by a single junction is generally of the order 1/10 volt. Higher voltages may be produced by connecting a large number of thermo-elements in series.

Thermo-electric generators are particularly useful when low temperature heat sources are available. The heat rejected by steam and internal combustion engines would be gratefully received by a suitable thermo-electric generator. Russia is producing compact generators which are used to power radio transmitters and receivers located in remote areas. Small kerosene lamps provide the heat input, and the cold junctions are maintained at low temperature by cooling fins (fig. 6).

Fig. 5 demonstrates how the effi-

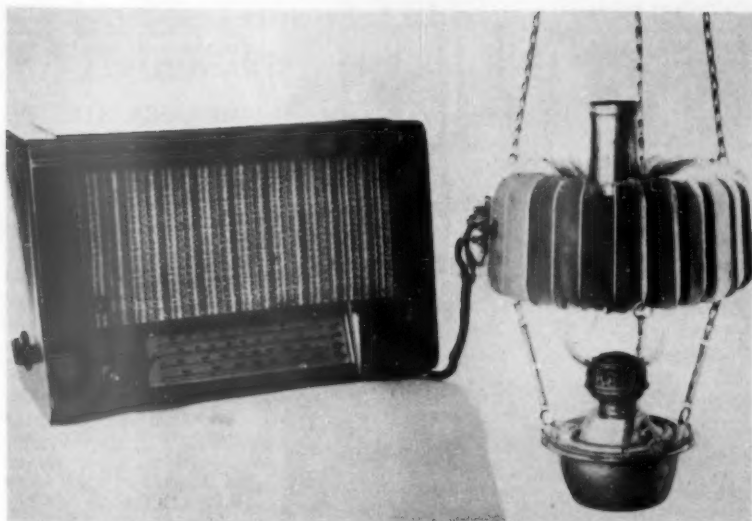


Fig. 6.

ciency of generation improves with high operating temperatures. A search is, therefore, being made for materials of high melting point. Certain impregnated ceramic materials have shown great promise.

The use of thermo-electric generators in association with nuclear reactors would provide a sophisticated alternative to present clumsy equipment. Perhaps the most attractive proposition of all is

provided by nature herself. It has been estimated that the solar energy falling on an area of approximately 100 kilometres square could provide enough power for the entire world. Solar power plants of conventional design have proved an uneconomic proposition. However, estimates have shown that thermo-electric power plants would be feasible on a small scale and possibly on a large scale in the

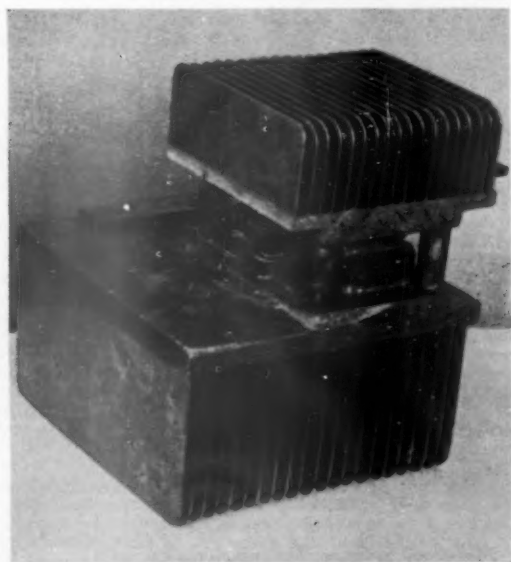
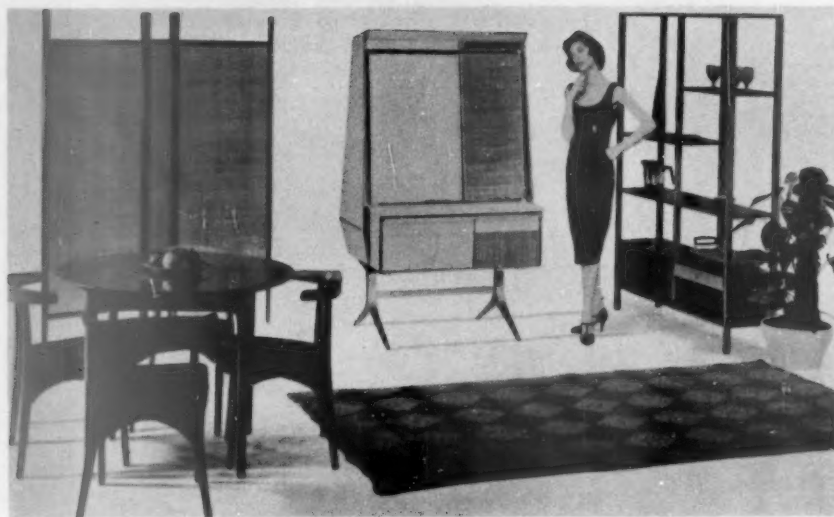


Fig. 7.—Complete heat exchanger.



Fig. 8.—A thermo-electric refrigerator produced in Russia. The power consumption is approximately 50 W.



We are indebted to Infoscarch Ltd., London, for the illustrations, fig. 3, 6, 7 and 8, from the Russian book, "Thermo-electric Cooling."

Fig. 9.—Westinghouse (U.S.A.) prototype thermo-electric refrigerator.

future. An exciting venture in this field was the construction of solar powered thermo-electric generators to provide the "bleep" in Sputniks.

Conclusions

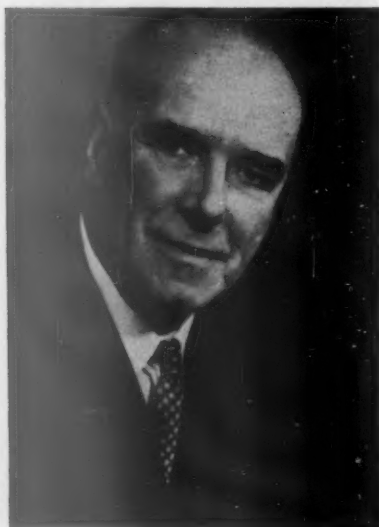
This brief survey of thermo-electricity should give

the reader some idea of the dramatic progress that has been made in recent years. The examples presented in this article portray the present trend in this exciting field.

The future lies before us, limited only by the imagination of engineers.

MR. H. R. HOWELLS

Retires from Lloyd's Register of Shipping



Mr. H. R. Howells retired from the position of principal surveyor for refrigeration, Lloyd's Register of Shipping, on January 31. His many friends

in the industry will wish him many years of happy retirement.

Mr. Howells, in addition to his official work, has been a tower of strength in Institute of Refrigeration and I.I.R. circles and his experience will be greatly missed. His many technical connexions in the engineering and marine world have been so numerous, that it is possible to record them only in bare outline:

Born in January, 1894, Mr. Howells was educated at Barrow Grammar and Technical Schools, and his career ran as follows: engineering apprenticeship 1910 and 1911 in Odessa, S. Russia, and afterwards at Vickers Ltd., Barrow-in-Furness; subsequently served in oil engine drawing office and joined the Royal Navy Submarine Service in March, 1916; commissioned in 1918; on leaving the Navy returned to the drawing office in Barrow for three months; subsequently five and a half years mostly at sea as marine engineer in Union Castle Line, Tankers Ltd., and Blue Funnel Line; experience in passenger, tankers and dry cargo ships with steam and oil engines including the Scott-Still engine; appointed to Lloyd's Register of Shipping June, 1925, and served in London, Leningrad, Sheffield and Liverpool; with the Food (Defence Plans) Department of the Board of Trade from May, 1938, in connexion with cold storage; appointed deputy director of Cold Storage in September, 1939, and director in 1943; returned to Lloyd's Register of Shipping at the end of 1945; senior surveyor in Manchester, January, 1946; appointed principal surveyor for refrigeration, London, in August, 1947, which post he retained up to his retirement; member of the Institute of Marine Engineers since 1925; member of the Institute of Refrigeration from 1943; president of the commission dealing with refrigerated transport by water of the International Institute of Refrigeration from August, 1950, to September, 1955; appointed an honorary member of the International Institute in November, 1956; continued as member of commission up to July, 1957.

Air-Conditioned Litho Plate-making Room

ALITHOGRAPHIC plate-making room, fitted with air-conditioning equipment which will produce conditions that may be experienced in members' printing-down departments, is now in operation at the laboratories of the Printing, Packaging and Allied Trades Research Association.

The department has also been provided with an automatic exposure meter, which shuts off the arc light for the printing-down frame when a pre-determined exposure has been given to the plate.

The equipment has been installed primarily for research work on lithographic half-tone reproduction which requires the accurate control of as many variables as possible. By having this accurate control system, PATRA is now in a position to test the efficiency of litho plates under a range of conditions. Arrangements have already been made for tests to be carried out on a batch of pre-sensitized

plates manufactured by a member firm.

The humidifying equipment permits humidities of from 55 per cent. R.H. to 75 per cent. R.H. to be obtained, with a temperature range of from 60° to 75° F. Conditions can be controlled to within an accuracy of ± 2 per cent. R.H. and $\pm 2^\circ$ F.

Humidification is achieved with an "Aerosol-Turbo" unit, while de-humidification is provided by a refrigerator incorporated in an air-conditioning unit. Conditions are kept constant by means of an automatic control system of humidistats, consisting of moisture-sensitive elements and a series of thermostats.

A booth fitted with an extractor fan has been built to house the open arc lamp assembly so as to ensure that the heat from the lamp does not affect the atmospheric conditions of the room.

The provision of the exposure meter, consisting of a photocell coupled to a switching unit, means that troubles caused by variations in intensity of the arc due to power fluctuations can be eliminated. In short, the meter takes the guesswork out of making exposures.

COMMANDER W. R. SINCLAIR AS LIGHTFOOT CONSULTANT AND DIRECTOR

COMMANDER Walter R. Sinclair retired from his executive position as technical director to The Lightfoot Refrigeration Co. Ltd. on December 31, 1958. He will continue as a director on the boards of The Lightfoot Refrigeration Co. Ltd. and Lightfoot Cold Stores Ltd., and will also be

Commander Sinclair will continue to serve on various technical committees such as those of the International Organization for Standardization, British Standards Institution and l'Institut International du Froid.

Mr. Kenneth Lightfoot, O.B.E., chairman, The Lightfoot Refrigeration Co. Ltd., writes: "I feel sure that all of us who have had the privilege of working with Commander Sinclair will wish him long life and every happiness in his 'semi-retirement' and will welcome the opportunity of keeping him in touch with our day-to-day activities and seeking his advice and guidance in the future."



retained as a consultant to the parent company, for which purpose he will be in attendance at Wembley during the fourth week of each calendar month.

Mr. Robert E. Cryor, president of North American Asbestos Corporation of Chicago, American subsidiary of The Cape Asbestos Co. Ltd., has been elected president of Cape Asbestos (Canada) Ltd., of Toronto, and Caposite Insulations Ltd., of Sarnia, Canadian subsidiaries of Cape Asbestos. This election follows the death of Mr. L. W. Dennis, first president of Cape Asbestos (Canada), last summer. Consumption on the North American Continent of raw asbestos from the Cape Group's South African mines and of manufactured asbestos thermal insulation materials from their factories in Britain, is now considerable. "Asbestolux" asbestos insulation board made at Uxbridge was introduced to the U.S.A. for the first time last year and has been well received. At Sarnia, Ontario, Caposite Insulations Ltd. manufacture "Caposite" amosite asbestos moulded insulation pipe sections.

Heat Exchangers Aid Field Production of Guided Missiles

BRAZED aluminium heat exchangers are helping the Army solve the problem of fuelling missiles in the field. The exchangers are used in a new million-dollar mobile liquid oxygen producing plant for on-the-spot fuelling of guided missiles, states the Trane Company, Wisconsin, U.S.A.

Supplying liquid oxygen to missile launching sites on any potential battlefield has always been one of the Army's most difficult logistical problems.

The tremendous propellant power required for the Redstone missile, for example, is obtained by combining ethyl alcohol with liquid oxygen.

Rising to heights where there is little or no oxygen for combustion purposes, a missile must carry its own large supply of this oxidant. A cold, light blue liquid, produced and handled at 297° below zero, liquid oxygen is one of the best oxidizing agents known. Pure oxygen has more than four times the combustion power of air, and liquid oxygen 600 to 800 times the combustion power, volume for volume, of gaseous oxygen. This tremendous concentration of energy potential has made liquid oxygen a mainstay in missile propulsion.

Large quantities of liquid oxygen are needed for a missile, whether in flight or to keep it ready for launching. Without the extremely low temperatures needed to keep this oxygen in the liquid state, it boils away rapidly. In addition, missile bases are prime targets and the bases and all supporting equipment must be capable of movement on short notice. Obviously the conventional liquid oxygen plant

could not meet these requirements. The problems are solved by the compact mobile plant, which can produce 20 tons of 99.5 per cent. pure liquid oxygen per 24-hour day near any missile launching site.

Mobile Heat Exchangers

It was an engineering achievement to compress this volume-production industrial plant into four semi-trailers, each 30 ft. long, 8 ft. wide and 11 ft. high.

The components of the four trailers included in the 20-ton-per-day unit are: (a) two identical air source trailers consisting of air compressors and diesel engines; (b) the heat exchanger semi-trailer in which air is liquefied before separation; (c) one air separation semi-trailer in which the air is separated into its various components.

According to a spokesman of Air Products, Inc., Allentown, Pa., builders of the mobile plant "Trane brazed aluminium heat exchangers were used in this design because they provided the greatest surface area, in the smallest package with the lowest weight factor. The low weight factor and small size are, of course, highly important in an application of this type. It is believed that the Trane exchangers are of such construction that they will withstand the rigours of transportation. In addition to the engineering aspects mentioned, Trane exchangers were used because they provided the lowest cost equipment capable of performing satisfactorily in an application of this type."

The Trane heat transfer units consist of a stack of layers, each layer having corrugated aluminium sheets between flat aluminium plates to form separate passages for the flow of liquids and gases. Formed aluminium channels seat the individual passages.

Liquid Oxygen Production

Production of the liquid oxygen may be best understood by referring to the simplified flow



Mobile liquid oxygen producing plant for on-the-spot fuelling of guided missiles.

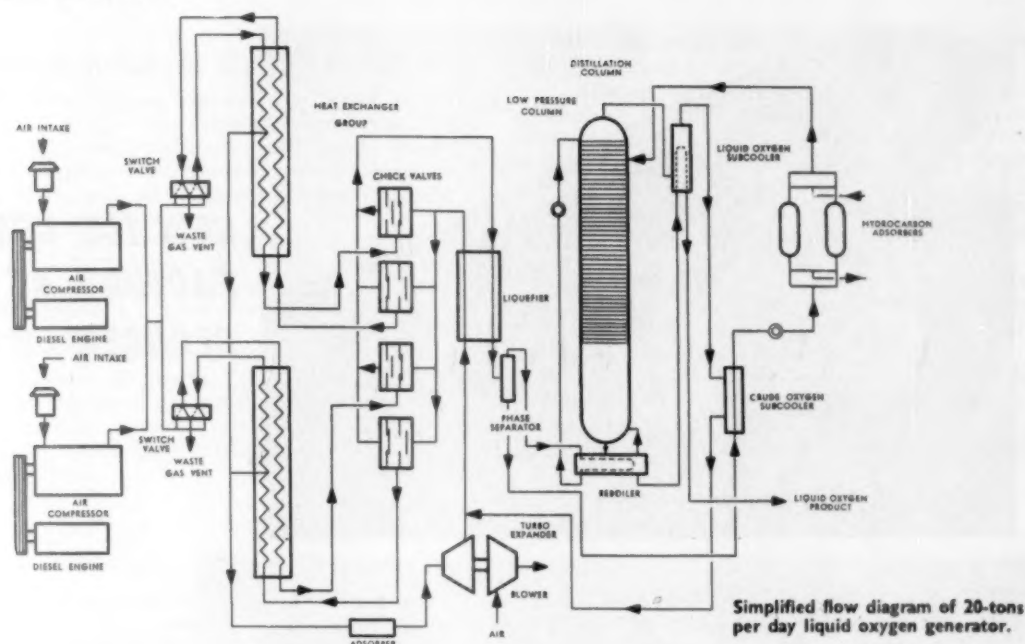


diagram above. It begins in the two air source trailers. Here, air-cooled Trane intercooler and after-cooler exchangers are used to remove the air of compression from the main air supply.

Each air supply trailer carries a diesel engine and compressor capable of delivering large quantities of air at 100 psi.

The compressed air is fed into Trane exchangers and cooled by intensely cold nitrogen extracted in the air separation trailer. This freezes out water vapour and carbon dioxide impurities from the air stream.

Periodically, the air is rerouted through alternate passages by reversing valves and check valves, while these impurities are ejected by a blast of nitrogen. The air leaves this exchanger very near to the liquid state.

The air separation unit completes the process of changing the cold compressed air into liquid oxygen

and by-product nitrogen. Partly liquefied air, produced by heat exchange with discarded nitrogen gas, is first separated from gaseous air by a centrifugal separator, subcooled and passed into the distillation column, where the nitrogen is separated from the liquid oxygen by evaporation. The pure liquid oxygen can then be drawn off and hauled to the missile site in special low-temperature trucks, having a capacity of nine tons.

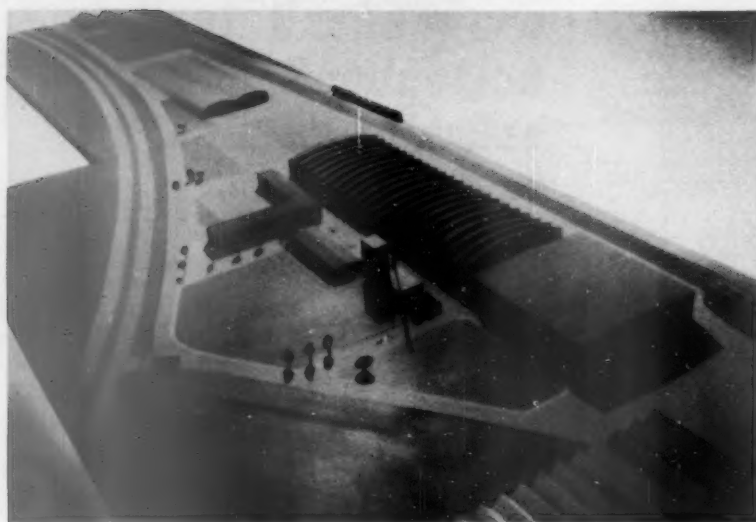
Economical Production

A key factor in the success of this complex liquid oxygen plant is the economy and efficiency of the equipment. Approximately 2 lb. of liquid oxygen can be produced for every pound of fuel oil consumed by the diesels.

Eight of these million-dollar plants have been delivered to the Corps of Engineers.

What is claimed to be the world's most versatile and flexible analogue computer, the Beckman/Berkeley "Ease," type 1100, with digital output input translation, was flown to Britain early this month to be exhibited privately by the Beckman/Berkeley agents in Great Britain, Winston Electronics, Ltd., Shepperton, Middlesex. The computer will be set up and demonstrated in a place in Central London to those interested, who should communicate with Mr. Keith Laurence, sales director of Winston Electronics, Ltd. The full-scale demonstrations of the scope of this computer are on February 10, 11 and 12.

A series of ten weekly meetings on production control have been arranged by the British Institute of Management in collaboration with the Institution of Production Engineers for production managers, general managers and production controllers. Commencing on Tuesday, March 17, these meetings will be held at 2.30 p.m. each week in Management House, Fetter Lane, E.C.4. This study group will provide those taking part with an opportunity to meet and consider various aspects of production control. At each meeting a new aspect of the subject will be introduced by a leading authority who will then act as study group leader.



NEW ICE CREAM FACTORY AT GLOUCESTER

T WALL and Sons (Ice Cream) Ltd., have just completed plans for erecting the most modern ice cream factory in the world in Gloucester. Work on it will begin within the next few weeks and it is anticipated that it will be in production in 1960.

The building of this factory has become necessary owing to the steady increase in demand for ice cream all the year round and provision has been made in the plans for eventual further expansion.

Gloucester was chosen because it is ideal geographically as a distribution centre; the output of the factory will be going as far afield as Carlisle, Caernarvon and Penzance. It was also necessary when selecting the site to choose a place where labour would be readily available.

On the site, which covers nearly thirty acres, a number of ancillary buildings will be erected beside the main factory. The latter will consist of a ground floor where the ice cream ingredients will be kept under ideal conditions, with the mixing tanks, compressors and locker rooms housed on the same floor, and a top floor which will house the gleaming stainless-steel production lines where as many as ten different types of ice cream can be produced simultaneously under perfect hygienic conditions. Production can be at the rate of about 45,000 gallons of ice cream per shift.

Adjacent to the main plant there will be a cold store where the newly made ice cream will be stored for a short while prior to being despatched to the various depots in the north, north-east and west of England, for general distribution. On the same site there will also be a distribution depot to cover the Gloucester area. A wafer factory is also to be built and is expected to start production before the end of the year. The important buildings will be the repair shop, where all refrigerators belonging to the company will be overhauled and maintained, and the

transport workshop, where maintenance, body building, painting and overhauls can be carried out on the fleet of vehicles operated by Wall's in this part of the country.

A separate facilities block will house the administrative, managerial and medical staff, together with laboratory and processing technicians. A canteen where the staff will be able to obtain subsidised hot meals will be built at a central point on the site.

Introduction has been made within the factory of new processes and new ideas designed to improve both the quality and variety of ice cream, as a part of the company's continual endeavour to improve service to the consumer.

While the factory will be as fully automatic as is consistent with efficient operation, there will be work for nearly 650 people, rising to 1,000 in the summer. Construction and operation of this factory, where people will be able to work in ideal conditions, are expected to increase the prosperity of the surrounding district.

AMERICAN QUERY

One of our American readers, M.L.S. Refrigeration Company, North Miami, Florida, writes to the editor as follows :—

"We have a problem that perhaps some of your ingenious service engineers may be able to help us with. We would like this to be published, if possible, in your letters-to-the-editor column. This is the problem—Is it possible to convert a gas-fired (main or bottled gas) absorption domestic refrigerator to kerosene? If so, what would be the recommended way to do it and is there anybody engaged in the manufacture of such kits? The editor will be glad to forward all replies

Thermo-electric Refrigeration

THE Westinghouse Electric Corporation in the United States has recently developed five radically new "prototype" appliances, including a thermo-electric refrigerator, operating with no moving parts, and an ultrasonic dishwasher that cleans with sound waves.

Translating into practical equipment the scientific principles of thermo-electricity which creates cold directly from electricity, and high frequency sound, the new appliance prototypes give promise of "revolutionizing the kitchen of to-morrow."

Although these products are not yet quite ready for the commercial market, they prove that the laboratories of American industry are endeavouring to revolutionize to-morrow's kitchen and home design and the traditional methods of accomplishing household tasks.

Besides the thermo-electric refrigerator, other company developments are as follows:—

1. A small, thermo-electric dehumidifier that can be used to keep crisp crackers, potato chips and similar items which spoil in humid weather, or can be placed in a clothes closet to eliminate moisture;

2. A refrigerator made up of sections, cooled by conventional means from a central source, but styled like furniture with compartments that are accessible from more than one direction;

3. An electrical distribution centre for cooking that combines for the first time both high-speed electronic and conventional electric cooking with full-size and small appliances.

While the five items are not ready for the commercial market, but are prototypes for the home of to-morrow, they demonstrate the diversity of design and function possible with new scientific techniques.

Picture of the Month



This delightful, contemporary showroom has recently been put into commission by The Lightfoot Refrigeration Company Limited at Wembley.



First All-Aluminium Refrigerator Wagons for Canada

WHAT are believed to be the first refrigerator wagons of all-aluminium construction have been built for Canadian National Railways. The five prototypes are the outcome of maintenance and corrosion troubles experienced with conventional wagons and attributable to the brine solution used in the cooling systems, we learn from the Northern Aluminum Co. Ltd., Banbury.

Previously, the use of aluminium in refrigerator wagon construction has been limited to such applications as roofs, interiors, and in one experimental case, exterior sheets.

The new wagons, designed by the C.N.R. in conjunction with the Aluminum Company of Canada Ltd. (Alcan), and the builders, National Steel Car, embody certain special features that are creating wide interest in the North American industry. These include a composite riveted and welded aluminium underframe; an all-welded aluminium floor with a curved inside sill section to facilitate thorough cleaning; and aluminium brine tanks equipped with drain tubes leading to air-tight drain traps to feed overflow directly from the wagon. Two of the wagons are provided with an improved type of aluminium meat rack, while in all cases the design allows an increased thickness of insulation material to be used. Insulation is further improved by the reflectivity of the unpainted aluminium sheet roofs and walls.

With the exception of the bogies, charcoal heater, door and hatch hardware, and certain safety equipment, all parts of the wagons are of aluminium, which has resulted in each wagon being some 22.5 per cent. lighter in weight than those previously operated by C.N.R. This represents a saving of about 7 tons per wagon, reducing rolling resistance and promising economies in operation.

The five prototype units are being subjected to a programme of tests more extensive than any previously carried out in Northern America, and it is expected to eliminate the customary service testing requirements by the Canadian railways of five to ten years on new equipment.

Four of the wagons are in regular service with the C.N.R. and their performance under normal service conditions is kept under close observation. The



One of the five Canadian National Railways' all-aluminium refrigerator cars being prepared for the test programme. The car is being loaded with sandbags to simulate the meat rack load, and the trucks are supported on jacks for accurate weighing with load cells.

fifth wagon was equipped with strain gauges during construction and is currently being prepared for a static road test, the first of a series of four tests. Strain-gauge readings and deflections will be recorded for various conditions of the road, both on the meat rack and on the floor. Other tests to be carried out include a road test where strain-gauge readings will again be used to indicate the stress levels encountered on the wagon during operation; a fatigue test will be undertaken and reproduced by Alcan's research affiliate, Aluminium Laboratories Limited at Kingston, Ontario; and finally there will be a series of impact tests.

On completion of the tests, the analysis of the results will be compared with the stress analysis which preceded the design, enabling any weakness or excessive strength to be corrected in future wagons.

FIRST FROZEN FOODS EXHIBITION

Owing to the unprecedented demand for the exhibition space by manufacturers of equipment for use by producers of frozen foods, it has been decided by the organizers to split The First International Frozen Foods and Equipment Exhibition at Blackpool in September into two distinct exhibition halls which will be joined by a corridor. One exhibition will be devoted to frozen foods and the joining exhibition hall will be entirely for equipment used in the production of frozen foods such as refrigerating and storage equipment, frozen food dispensers, packing and carton making machinery and such equipment as is used by the producers of frozen foods. The equipment section will be the most comprehensive ever yet seen in this country devoted to the production of frozen foods.

Components' Manufacturer who will "tackle anything"

THE range of products coming out of the small works of I. F. Eyles (Refrigeration) Limited at Chalford in the Stroud valley is quite remarkable. This versatility in production has had, of course, to be linked to quality manufacture to have achieved the success which has come the way of the Belvedere Works and it is perhaps of interest to take a look at the origins of this firm.

The moving force in this organization is, without doubt, Mr. I. F. Eyles himself and the reason for his setting up in this line of business, after being demobilized in 1945, can best be told in his own words to "M.R." :—"Before the second world war, large quantities of components were imported into this country and in many cases manufacturers standardized on those parts, because the fittings and hole centres etc. conformed to refrigeration standards which had been chiefly laid down by America. Unfortunately, due to dollar shortages and other currency restrictions at the end of the war, those components were only imported in very limited quantities. This resulted in serious delays in the production programme of most of the refrigeration manufacturers in this country, with the subsequent loss of vital export business. To combat this state of affairs, the firm of I. F. Eyles came into being with the aim of producing quality components which conformed in every possible way to the standards of the refrigeration industry. Since this time, many thousands of components have been supplied to the leading manufacturers of the industry in this country and now substantial quantities are being exported."

Mr. Eyles was for a time after the war production manager for a large firm in north London and in 1947 he set up on his own account. There was a shortage at that time of water-cooled condensers, driers, strainers, liquid receivers, heat exchangers, oil separators, etc.

He set out to remedy this shortage and to specialize in "awkward" components. He also went into the "packaged market," making, in particular, packaged liquid chillers, incorporating shell and tube condensers, dry expansion evaporators. He claims to have

been the first to have offered to the whole trade the latter products.

To-day, the firm specializes in "tailor-made" requirements of manufacturers in this type of equipment, paying special attention to compact overall dimensions. In addition many types of coolers are produced for water, brine, sulphuric acid, benzole and nitric acid and various appliances for atomic research are manufactured.

In the early "50s" Mr. Eyles became interested in low temperature applications of aerosol filling equipment and later patents were taken out in this field. Pressure filling aerosol equipment was developed but this side of the business has now been disposed of, although the low temperature aerosol section has been retained. Such plant is to be found on the premises of most contract fillers in this country.

Other lines which keep this small factory fully employed (there is talk of considerable expansion taking place) are "tailor-made" evaporative condensers up to 150 tons for indoor and outdoor use (these prove particularly satisfactory where silence of operation is important); large numbers of small drinking water coolers of entirely non-ferrous construction; also similar types for mineral waters; coolers for machine tool trade—for cooling cutter coolants, broaching oils and grinding and lapping coolants; packaged crane cab coolers have also been successfully built; large quantities of 25/30 ton water chillers for Middle East oil companies; hermetic repair kits—these are very versatile and incorporate voltmeter, wattmeter, megger, oil-charging cylinder and refrigerant-charging cylinder, and vacuum pump—allowing all electrical and refrigeration tests to be carried out *in situ*. As a result of the considerable experience



Mr. I. F. Eyles.

gained in the aerosol field, in which "micrometer accuracies" are necessary the firm has been able to produce a hermetic charging set, in several sizes, the most popular model being that delivering a 32-oz. refrigerant charge. With this it is possible to charge oil (20-oz.) and refrigerant (32-oz.) in a combined cycle in under 10 seconds with an accuracy better than ± 1 per cent.

Of particular interest to servicemen is a large scale drier for temporary installation in the line, in which is incorporated a sight glass; the drier is charged with 1-lb. Union Carbide molecular sieve desiccant. Another piece of equipment with the Eyles trade mark is a magnetic suction line filter developed for the prevention of scale and cast iron dust returning to the compressor.

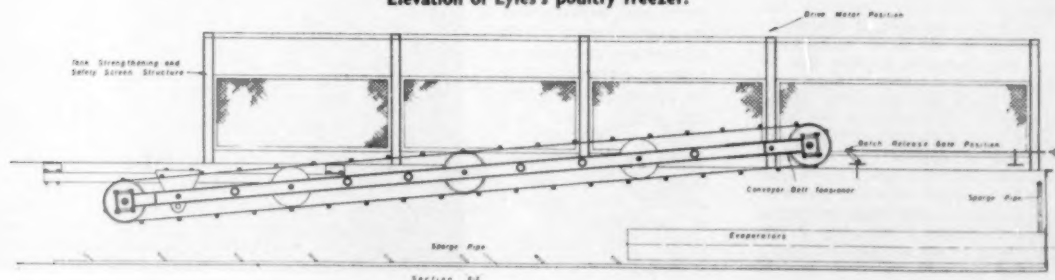
Over the past 18 months, packaged, immersion freezers for poultry have created considerable interest.

In basic form the freezer consists of a 10 s.w.g. mild steel tank with a 2 in. angle turned out, welded around the top, the whole is galvanized after manufacture.

In this tank are situated two shells for dry expansion evaporators; in each shell is fitted a tube bundle divided in two entirely separate circuits, the refrigeration capacity of each circuit is 30,000 B.t.u./hr. or more with "Arcton-12" at a temperature of minus 5° F. The evaporators are fed with brine from 1½ h.p. pumps; after passing through the cooler this brine is fed to the sparge pipe on the inlet end of the tank. This sparge pipe promotes a strong forward current on the surface of the brine. Inside of the tank and partly submerged in the brine is an endless conveyor belt of special construction. The speed of the conveyor belt can be adjusted by a variable speed drive from approximately ½ ft. per minute to 2 ft. per minute. The width of the conveyor belt is 57 in. and the length variable. The maximum through-put for a given depth of freezing will depend on the size of the bird and the number which can be accommodated underneath the belt at any one time.

With the batch release gate in the open position birds are fed into the receiving end at a rate determined by

Elevation of Eyles's poultry freezer.



the speed which the conveyer belt can deal with them. This in turn is determined by the time the customer requires the poultry to be submerged (which, of course, is also a function of the temperature of the brine). The strong forward current on the surface of the brine carries the birds forward towards and under the conveyer belt. The loading area is approximately 30 sq. ft. and from the foregoing it is clear that if only one bird is fed in every 10 seconds and a 18½ ft. conveyer is running at 1 ft. per minute the through-put cannot exceed six birds per minute for an 18½-minute total immersion period; on the other hand if 20 birds a minute are fed into the machine the total number of birds submerged is 20 by 18½ which equals 370 per 18½ minutes. Naturally it is impossible to give a hard-and-fast figure as to the quantity of birds which can be held under the conveyer at any one time as this is solely dependent on their size and, in the case of a packing station where batch grading for weight is used, it will vary from batch to batch.

In the case of batch grading the batch gate is closed and the poultry fed into the receiving end and allowed to accumulate for a time, dependent upon the whim of the user, but let us say in this case, three minutes. It is possible that this time can accumulate while the actual loading is being effected; this means that 3 ft. of empty conveyer belt has now gone forward (freezing, however, is still going on within the chicken, but obviously not in that portion which is above the brine), as soon as loading is complete the batch release gate is opened and the whole batch commences to feed under the belt. At the outlet end a stage has now been reached when the birds are no longer delivered from the belt; in other words, the commencement of the 3 ft. of dead belt has been reached, this giving sufficient time for the clearing of the receiving end. Needless to say, it is unnecessary to keep closing the batch gate unless the grading of the individual batch changes. From this it can be seen that a very high rate of through-put can be achieved and at the same time the depth of freeze can be adjusted (by varying the belt speed) for the individual size of poultry per batch and there is no fear of the stray bird passing quickly through the tank, as is often the case with other types of freezers.

Due to the experience gained in the manufacture of poultry freezers it has been found that the size of this particular freezer is the most economical compromise all round because due to the large quantity of brine, 2,000 gallons, held in the tank, the newcomer whose through-put is comparatively low need not spend a large amount of money on refrigeration equipment in the first case only to find that when his output goes up he is faced with the problem of requiring a new and larger refrigeration equipment and a new and larger tank, as one is no use without the other.

To make the installation as econo-

mical as possible it can be arranged to commence operations with one 5 h.p. condensing unit connected to only one circuit of the two coolers, the second cooler shell of necessity still has to be supplied but the freezer can be purchased without the second bundle, which can be added at a later date. When the through-put exceeds the capacity of the 5 h.p. condensing unit, and it must be borne in mind that advantage can be taken of the overnight pull down to get more from this machine, a further 5 h.p. machine could be added on to the second circuit of the first cooler. Alternatively one 10 h.p. machine could be fitted directly to both circuits of this cooler and the original 5 h.p. machine could now be used to refrigerate the extra cold room capacity which will obviously be needed for the increased through-put. The third stage is now reached where the second coil bundle is purchased and a further 5 h.p. condensing unit added to one circuit (the cold room capacity should still be adequate on the existing plant) and finally when the fourth stage is reached a 10 h.p. condensing unit is fitted to number two cooler and the 5 h.p. unit originally fitted to this cooler used to further increase the cold room capacity.

From the above it is seen that on the final set-up the user has a freezer capable of an output of 120,000 B.t.u./hr plus the overnight pull down and cold room capacity in three stages, which if demands are high, means that it is quite possible that one of these cold rooms is not even running and can be used as a stand-by for reserve capacity against increased seasonal input of poultry. Quite naturally the plant is suitable for other types of poultry than chickens, turkeys etc. hence the ability to slow down the belt to enable a greater depth of freezing to be achieved. It is recommended that the minimum thickness of insulation on the tank should be 6 in.

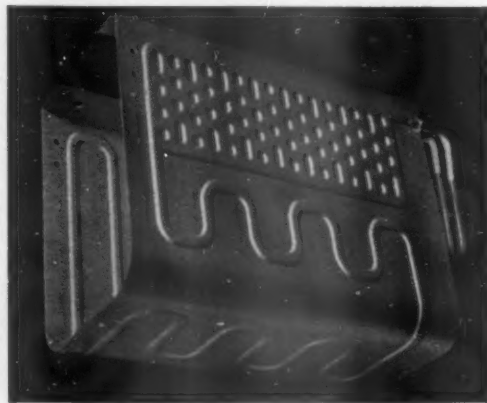
It might be argued that the plant is

too large in the first case and a smaller plant would be a better selling proposition but it will be seen that even if the tank was made only half the width the direct saving would be extremely small; one evaporator shell could be saved, half the width of conveyer belt and a strip of ¼ in. plate approximately 35 ft. long and 2 ft. 6 in. wide, this in itself constitutes a very small saving and halves the final capacity of the machine. It is virtually impossible to cut down the length of the machine without increasing the width, because now to get the through-put it would be necessary to run the belt at a very much slower rate; in other words, half the speed with the conveyer belt twice as wide, this in turn produces mechanical problems from the point of view of twice the number of bearings, extra idler wheels and a conveyer belt which would have to be in the region of 9 ft. 6 in. wide. The price of conveyer belt is not directly proportional to its width but increases very rapidly per unit foot after a width of 6 ft. has been reached. A tank in the region of 10 ft. by 15 ft. becomes somewhat expensive on floor space and unwieldy from an operational point of view.

From this it can be seen that to shorten the tank and even have the same capacity will increase the price considerably; to decrease the width of the tank by 50 per cent. will reduce the cost of the tank by no more than 10 per cent. Although not mentioned above, sufficient margin has been left that even another 10 per cent. capacity can be had from the existing machine by increasing the pump delivery which would in turn increase the heat transfer rate of the two coolers from 60,000 B.t.u./hr. to about 68,000 B.t.u./hr., against which would have to be taken approximately 3,000 B.t.u./hr for the added pump horse power. This assumption is based, quite naturally, on the fact that the condensing units are capable of dealing with the increased capacity.

The Northern Aluminium Co. Ltd. have issued a leaflet describing one of their latest products, "Noralduct"; this is solid aluminium sheet having internal systems of passages and ducts. It is particularly suitable for heat transfer equipment and, as the integral passages can follow almost any complex continuous pattern that can be drawn on paper, there are many other possibilities. Noralduct is made by superimposing a sheet of Noral alloy on another sheet, on which a fore-shortened impression of the required tubing pattern has been

printed, by a silk-screen process, in a special "stop-weld" ink, and then



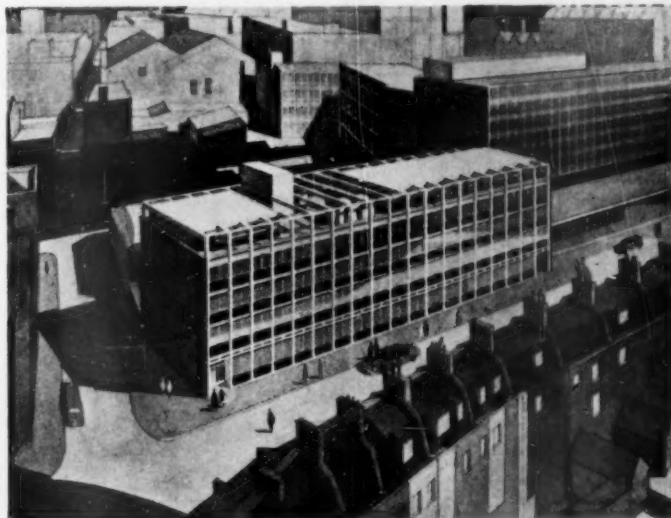
passing these sheets through a rolling mill. The high pressure that is exerted causes the aluminium to unite in all areas except those that have been inked. The rolling of what is now one sheet of metal is continued until the required final gauge and size have been obtained. The sheet is then held between rigid plain platens

and the printed areas are hydraulically inflated, becoming ducts and chambers in solid sheet.

Sheets of Noralduct can be formed after manufacture, as are those used in refrigerator evaporator components, for example. Either a plain or an impressed pattern finish is available and colour can be included in

the product design as there are no welds to spoil the appearance of an anodised finish. The folder includes lists of the present uses of Noralduct and some of the possible ones, together with a short description of its manufacture, and a guide to its present tolerances and manufacturing limits.

PROPOSED BUILDING FOR THE NATIONAL COLLEGE FOR HEATING, VENTILATING, REFRIGERATION AND FAN ENGINEERING



"Many of you will have seen this evening for the first time the picture of our proposed new National College, at least the college we are sharing with the heating and ventilating and fan industry," declared Sir Rupert De la Bère at the Institute banquet. "We announced at this dinner last year that the project was to go ahead and it was pointed out that we were to receive an extremely small share of the £84,000,000 now being spent on technical education. I believe we told you that £125,000 was being allocated by the Ministry of Education and we pointed out the inadequacy of this. However, the governors of the college, strongly aided and abetted by your own representatives on the governing board, have now been able to agree with the Ministry the details of the design of the college at the increased figure of approximately £200,000. If this college is to meet the requirements of industry during the foreseeable future it is essential that it should be so equipped that teaching and research covering the whole field of the technology of refrigeration of to-day and to-morrow should be possible. The principle behind the National Colleges is a partnership between the Ministry of Education and industry. In this connexion it is hoped that our industry will do its best to see that the college gets the equipment it requires. Within the next few days you will be receiving an appeal for help to provide equipment. The appeal booklet, an advanced copy of which I have here, is not yet off the press, but I ask you to study the booklet with the care it deserves and then to give generously to a fund which I am sure will be used wisely and will bring lasting benefit to the industry."

* See page 164 of this issue.

Pressed Steel Co. Ltd., of Cowley, have formed a subsidiary company to represent the Pressed Steel Co. Ltd. in the "common market" countries. The name of the company is Pressed Steel Société Anonyme and its headquarters are at Galerie Ravenstein 30, Cantersteen 7, Brussels 1, where the showroom is

situated. The directors of the company are Mr. J. R. Edwards, managing director, Pressed Steel Co. Ltd.; Mr. F. E. Cairns, deputy managing director, Pressed Steel Co. Ltd., and Mr. T. M. Connelly, patent attorney, Pressed Steel Co. Ltd. Mr. Cairns has been appointed chairman and Mr. Connelly manag-

ing director of Pressed Steel Société Anonyme. Mr. Connelly will visit the Belgian organization regularly to promote the sale of motor car bodies and refrigerators in Europe. The Brussels showroom was originally conceived and opened with an eye to the European "common market" and the proposed free trade area.

Ernest West and Beynon's Golden Jubilee

THE 50th anniversary celebration of the foundation of the refrigeration engineers Ernest West & Beynon Ltd. of Bromley, Kent, was marked on the 23rd *ultimo* when the directors, staff and guests took dinner together in the home town and afterwards visited a London theatre.

At the dinner, Mr. V. B. Snowdon, chairman, presided. After the loyal toast had been given, Mr. R. Shearman, Admiralty inspector, proposed the toast of the company, and expanded on the theme that quality rather than quantity production had always been the order of the day in the small specialist factory of West & Beynon's; with this company he had always enjoyed most cordial relations and had always been extended every courtesy.

In reply, Mr. Snowdon said: "We are a small family concern founded in 1909 by Ernest West, one of the leading pioneers in refrigeration in the country. He took into partnership Herbert Beynon with whom he had been associated in business for a number of years. They were very successful and in a short time, the company became well known in the industry. The death of Mr. Beynon in 1926 was a serious blow but our founder continued in the business until he retired at the beginning of 1939. At that time, my father was approached by a member of the company and in association with one or two friends, we took over. My family were no strangers to West & Beynon since we had been suppliers to the company since 1919.

"In the rush and tear of modern business life, one seldom has the time to review in detail all the things a company does. This anniversary has been an opportunity for me to carry out a little research and if our founder were with us tonight, I think he would be justifiably proud of the impressive list of Government departments, public corporations and undertakings, well-known companies and business men who entrust to us the supply and maintenance of refrigerating plant. He would also be proud of the fact that some of these concerns who placed orders with him in 1909 are still customers today.

"Our founder established a reputation for high class workmanship and sound design. Some compressors which we built in 1912 are still giving good service today—we are proud of this and rather smug and unlike some manufacturers we can still supply spare parts for these old machines.

"Everyone is aware that refrigeration is used universally for the preservation of food but the extent to which our industry renders a service to the community apart from food storage is perhaps not so widely known. In addition to certain very important and highly specialized applications our company is responsible for refrigerating plant used in connection

with the following commodities and services: Boot and floor polish—carbon paper—drinking water cooling in the Tropics—electro-plating—face cream—glue—gelatine—lipstick—photography—a wide range of general hospital and research services and I have no doubt members of the staff are thinking of many other applications which I have omitted.

"A company is made up of its shareholders, directors and staff and here I must speak on a personal note," went on Mr. Snowdon. "I am indeed fortunate in that I have a first class team from my fellow directors to the most junior member of the organization. It is not possible to refer to individuals; we have five who have been with the company for over 30 years, others with many years' service, others who have not been with us so long but who have, without doubt, made their mark in the organization. You will agree that my address would have to be a very lengthy one to do justice to them all.

"There is a permanent atmosphere of urgency in this work—when a refrigerating plant requires attention, something has to be done immediately—a vital hospital service may be affected—valuable stocks of food may be in danger or the whole production of a factory employing hundreds of people brought to a standstill—I would like to pay tribute to the way in which all our staff do their jobs. The outside engineers work in emergency literally night and day, often many miles from home, frequently at great personal inconvenience to themselves and their families. The works' engineers put in long hours on urgent construction, repairs and machinery trials. The technical, sales and administrative personnel, without whom the company would not function, carry out their duties with a minimum of fuss and a maximum of enthusiasm. All take pride in their work, all know that the company has a duty to those many people who rely on it.

"I must also refer to our cordial relationships with other manufacturers of refrigerating machinery, our suppliers and all who go to make up the progressive and ever-expanding industry of refrigeration.

"For the future—if we uphold the company's traditions of quality, value and service then, with good fortune, a successor of mine may be privileged one day to address a similar gathering celebrating our centenary.

"He will indeed be lucky if he has with him such a pleasant assembly of colleagues and friends as I have tonight."

The toast of "The Guests" was very suitably put by Mr. A. L. Bannister, director, and amusingly responded to by Mr. L. A. T. Moss who was billed as "a satisfied customer". Altogether a most enjoyable evening was spent by all.

H.M. consulate-general at Houston has prepared summaries of the basic commercial facts about some of the leading cities in Texas and New Mexico which United Kingdom exporters may find of value in assessing their potentialities as markets for their products.

DOMESTIC REFRIGERATION DEVELOPMENTS



HOTPOINT EXPANSION

A.E.I.-Hotpoint Ltd., one of the largest British manufacturers of domestic appliances, have just announced the biggest expansion programme in their history.

At Llandudno Junction, work is already in progress on a major extension to the washing machine factory. This will more than double the productive capacity and will provide work for about 500 more people. This is an important contribution towards higher employment in North Wales. The new extensions will come into operation before the end of 1959.

At Peterborough, work will shortly begin on a major extension to the refrigerator factory. This, too, should begin to operate by the end of 1959. When complete, it will double the present output of refrigerators and will give employment to an additional 300 people.

Planning approval has already been granted for both these urgent projects.

Hotpoint predict an ever-growing demand for their products, both at home and overseas. A major new export drive is already under way and large new orders have been received from overseas markets.

At Peterborough, a new building will add 112,000 sq. ft. to the present manufacturing area. The west side of the building will be continuously glazed, and this, with patent glazing in the roof, will make the most of natural daylight, giving bright and pleasant surroundings to the operators. In addition, a very high level of artificial lighting will be provided. This will be of A.E.I.

manufacture and will include Mazda fluorescent fittings. A new substation with a capacity of 1,000 kVA will adjoin the building.

Manufacture of cabinets and of hermetically sealed systems, including final assembly and despatch, will then all be under one roof, with considerable gains in productivity and efficiency.

At Llandudno, where the very popular Hotpoint Countess washing machines are made, the whole factory is being replanned and expanded to double the manufacturing capacity. The optimum use of mechanization and special purpose machines will make it the most up-to-date appliance factory in Europe

and a showpiece in the A.E.I. group of companies.

The local authorities have especially welcomed the project, which will bring good jobs and steady employment to many hundreds in the Conway and Llandudno areas.

A.E.I.-Hotpoint is part of Associated Electrical Industries Ltd., the largest electrical group in the Commonwealth, employing over 100,000 people.

At the same time as these expansion schemes were announced, Lord Chandos, the chairman of A.E.I. (and of Hotpoint) gave news of a remarkable new plan designed to give greater security to hourly workers in all the A.E.I. factories.

KELVINATOR'S 1959 RANGE

Space engineering has produced a new range of Kelvinators, with clear to the floor design, which give more cold storage space relative to floor area occupied.

The 1959 range consists of cabinets of 4.6, 5.1, 6.8 and 9.1 c.ft. capacity. A fifth model of 9.1 c.ft. capacity is equipped with exclusive Kelvinator "magic cycle" automatic defrosting. Pressing a button defrosts the cabinet and the frozen food compartment so rapidly that frozen food and ice in the freezer will remain frozen, the correct storage temperature being maintained throughout. All the refrigerators in the new range have a frozen food compartment, equipped with a special all-weather evaporator to keep frozen foods safe at the correct temperature.

The 1959 Kelvinators are designated K46JT (4.6 c.ft.), K51J (5.1 c.ft.), K68J (6.8 c.ft.), K91J (9.1 c.ft.), K91JD (9.1 c.ft. with "magic cycle" automatic defrost).

These cabinets are available in white or champagne ivory.

Retail prices are :—

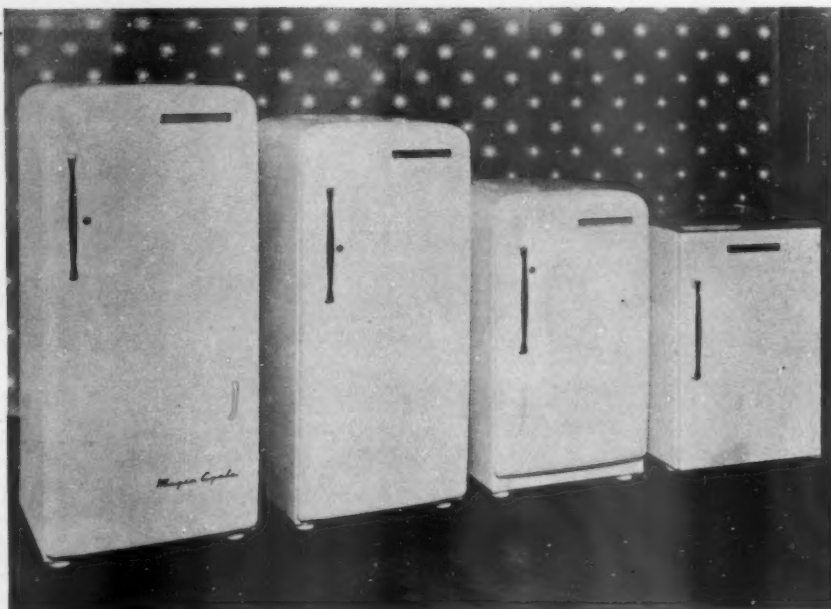
		<i>Purchase</i>		<i>Price</i>
		<i>Tax</i>		<i>Gns.</i>
Model		£	s. d.	
	K46JT	12	11 8	69
"	K51J	13	18 2	76
"	K68J	17	9 7	98
"	K91J	21	1 10	122
"	K91JD	22	17 6	132

Delivery of all these models is *ex stock*.

The K46JT is a completely new model, designed to incorporate into

DOMESTIC REFRIGERATION

Kelvinator's 1959 range of refrigerators from 4.6 to 9.1 c.ft. capacity. The left hand cabinet is equipped with "magic cycle" automatic defrost, a Kelvinator exclusive; the same size is available with push-button defrost. The table-top model is entirely new. These cabinets are in white or champagne ivory.



a table-top model advanced design features previously only seen in larger cabinets. These features include an inner door liner similar to the big cabinet type, suitable for bottles of milk, and a much larger dairy compartment. The door is hinged so that it opens within the external width of the cabinet.

The general styling reflects the tendency towards the sheer line square cabinet which is achieving marked popularity in U.S.A. and in several European countries.

The plastic liner has an adjustable shelf and for the first time this cabinet incorporates a full width crisper with a removable divider providing two sections in the crisper. There is a fully enclosed floodlight at the side of the cabinet adjacent to the thermostat control.

The redesigned table top, in a neutral shade of plastic, again stresses the clean lines and attention to functional design demanded by the modern housewife. A completely new latch of the push-pull type gives positive closing and finger-tip operation. The door seal is improved with a new knife-edge type of rubber gasket.

The K51J is the 1959 edition of the K47H which proved very popular in 1958. Increased capacity has been obtained by raising the height of the cabinet by 1½ in. A notable im-

provement in the appearance of the cabinet has resulted. This increase in height also permits additional



The new Kelvinator table-top model K46JT priced at 69 gns. including purchase tax. Capacity 4.6 c.ft. This model incorporates advanced design features normally associated with bigger cabinets. In white or champagne ivory.

space between the shelves and provides alternative positions to one of them.

The inner liner, similar to that of the K46JT, is of vacuum moulded plastic which ensures a neat trim. The internal floodlight at the side of the cabinet is completely enclosed.

The cabinet is fitted with locking device and the latch has been changed to the push-pull type to give again finger-tip closing.

The K68J is similar in internal styling to the 1958 Kelvinator K65H. The external design of the cabinet has been changed to conform with the whole range of Kelvinator refrigerators; the push-pull type of latch and the handle is similar to those on the other models in the range. An external locking device is fitted.

The K91J has been improved in its external appearance to conform with the Kelvinator range. This model is equipped with push-button defrosting, freezing beginning automatically after defrosting. The K91JD is fitted with the Kelvinator "magic cycle" automatic defrost.

The new Kelvinator factory at Bromborough is now in full production and the organisation has completely recovered from the disastrous fire which occurred at their Crewe factory two years ago. The anticipated heavy increase in demand from the home and export markets is now well within the capacity of the factory.

SALES OF NEW DOMESTIC APPLIANCES BY AREA BOARDS

The following return shows the number of new appliances sold by area electricity boards in England and Wales for the month of November and for the 12 months ended November 30, 1958, together with percentage changes over corresponding periods of the previous year.

When assessing the figures, it must be borne in mind that the sales by area boards represent only a part of total sales throughout the country.

	Sales in month ended November 30, 1958	Percentage change over corresponding period of previous year
Total		
Cookers ...	32,293	+ 57.1
Water heaters—		
Immersion	8,629	+ 18.5
Storage ...	4,970	+ 45.2
Wash boilers	6,857	+ 1.0
Washing machines ...	19,365	+ 225.5
Refrigerators	7,757	+ 275.8

INCREASE IN GAS APPLIANCE SALES

Even before the relaxation of hire purchase restrictions in the autumn, more gas appliances were being sold than in the previous year. For the six months April to September, refrigerator sales were higher by 78 per cent., gas space heater sales by 29 per cent. and water heater sales by 12 per cent.

Appliance Sales—Cash and Hire Purchase

Cookers, 260,400, 262,500, plus 0.8 per cent.
 Space heaters — gas, 31,200, 40,100, plus 28.5 per cent.
 Water heaters, 79,200, 89,200, plus 12.6 per cent.
 Wash boilers and washing machines, 114,600, 116,100, plus 1.3 per cent.
 Refrigerators, 14,900, 26,500, plus 77.9 per cent.

NEW PRESTCOLD MODEL

Aptly named the "Luxury Six," Prestcold's new D.671 refrigerator combines sound basic design with craftsmanship in manufacture and quality in styling and finish. With



The Prestcold D671 6.7 c.ft. refrigerator

a gross capacity of 6.7 c.ft. a considerable quantity of foodstuffs can be stored in it, for full use is made of the inner door and a large shelf area of 11.7 sq. ft. is provided. Another point worth notice is the unique Prestalok door-fastener, which is flush fitting and has an easy fingertip control with a key for locking purposes. The refrigerator also has concealed adjustable feet. Operating efficiency combined with utmost economy results from use of the Prestcold Econometer power unit. A stylish yet essentially practical refrigerator, the retail price including purchase tax is 98 guineas.

THE ASTRAL RANGE

Astral Equipment Ltd., of Dundee, state that, with one exception, their present range of refrigerators will continue to be offered throughout 1959. The exception is the 2.3 "Console" model. Until now, this has been fitted with Astral's standard "V" cooling unit with its comparatively small evaporator. From January onwards there has been released to the home market the export version of this refrigerator, i.e. the B.230-A model. This is the same 2.3 "Console" cabinet, but fitted with the "W" cooling unit, thus providing a large shelf-type evaporator all the way across the refrigerator interior.

DOMESTIC REFRIGERATION

NEW JACKSON REFRIGERATOR

The first refrigerator to be marketed under the "Jackson" trade mark was on view in London last month. Deliveries to the industry will commence immediately. This model, designated the "202," sells at 38 guineas.

The refrigerator will be first shown to the public on March 3rd at the Ideal Home Exhibition by which time stocks will be held in service centres and contractors' showrooms and in the electrical departments of the large stores.

The new method of moulding the cabinet is of special interest. The construction is unique inasmuch that the inner and outer cases are moulded in one complete piece. The material used is Astralon plastic which has been especially developed for double vacuum forming; it complies with the Plastic Federation Standards for use with food. There are no crevices or joins to collect dirt. It will not chip—it will not rust—it will not discolour with age, and is non-inflammable. Integral shelf runners and spillage trap, and the cabinet forms a chassis to which all other items are attached. A sheet-metal back section covers the whole of the back, extending to cover the cooling unit which is secured to the sheet metal.

Further details are:—

Colours: White cabinet inside and out. Grey plastic trims and thermostat knob. Ice blue and transparent blue door fittings and evaporator door. Gold anodized shelf trims and ice tray.

Ice-making Capacity: One ice tray producing eight large cubes and four small cubes. A second ice tray is available as an extra.

Dimensions: Overall height, 26½ in. plus 1 in. for thermostat knob. Overall width, 21½ in. Overall depth, 22½ in. including handle. Overall height on legs, including table top and thermostat knob, 34 in.

Volume: Gross volume H. × W. × D. of cabinet, 2 c.ft. Shelf area, 3.4 sq. ft.

Weight: 63 lb.

Heater Loadings: 85 watts, plus 5 minus 0 watts.

Supply Voltage: 200/220 volts. 230/250 volts, a.c./d.c.

Shelves: The two shelves are

DOMESTIC REFRIGERATION



Jackson 202 refrigerator of 2 c.ft. capacity with one-piece "inner" and "outer."

cranked for adjustment in height. Side runners are protected with white P.V.C.

Unit : The unit is of the absorption type. Unit is guaranteed for five years.

Thermostat Control : Simple dial control located at top left-hand rear corner of refrigerator (out of the way of small children).

Thermostat Knob : In grey plastic with white markings : Off ; 1 to 7 inclusive ; C for coldest.

Installation : No special fixing is necessary. Mains cable 23/0076 TRS complies with B.S. 7 Table 39. Refrigerator can be connected to a 2-amp. or larger plug. The evaporator must be levelled to within plus/minus 1 in.

MAIN 36.C. REFRIGERATOR

New for 1959 is the Main No. 36.C., an absorption type de-luxe refrigerator by R. & A. Main Ltd., available for operation by either gas or electricity and priced at £63 10s., including tax.

Designed to give silent, efficient and trouble-free service, the No. 36.C. carries a unique 10-year guarantee on its sealed cooling unit.

Available with white or cream exterior cabinet it retains the distinctive appearance of previous models—the cabinet top is gently curved and the shaped door, complete with makers' motif, has a chromium-plated pull-down handle. The interior has been greatly enhanced by the use of coloured vitreous enamel in an attractive shade of shell pink with matching breaker strip, coral red trims and anodised gold door shelf rails.

Extending across the full width of the top of the liner, the frozen food compartment is fitted with a spring-loaded self-closing door. Designed to make ice in room temperatures of up to 95° F. (35° C.), the compartment contains three ice trays with flexible dividers and will take about 4 lb. of frozen foods plus ice, or

approximately 6 lb. of frozen food with the ice trays removed.

With 3.6 c.ft. capacity and 7.7 sq. ft. shelf area the No. 36.C. provides really generous storage space. Three full-width shelves and one smaller shelf, all finished in bright chromium, are fitted, and the base of the liner acts as a fifth shelf. The door interior provides further storage—two shelves for milk, fats and small bottles and a recessed rack for eggs. Two covered containers for meat, fish or salads are also supplied. An unrefrigerated space of 1.5 c.ft. in the base is available for storing canned food and dry goods.

Automatic temperature control is achieved by means of a fluid expansion type thermostat which can be adjusted to suit room conditions, the control knob being conveniently positioned in the centre of the top breaker strip.

A defrost control is also provided on the gas-operated model, this being incorporated in the gas on/off tap situated in the plinth base. A flint lighter is also fitted.

The Main No. 36.C. electric model is available for operation on either 210, 230 or 250-volt a.c. mains.

MODERN REFRIGERATION

D.c. models are also available on request, at no extra charge.

Brief Specifications :

Refrigerating Unit.—Absorption type. Maximum input : gas model 1,000 b.t.u. per hour ; electric model 180 watts.

Temperature.—The unit and cabinet are designed to make ice in room temperatures up to 95° F. (35° C.).

Thermostat.—Fluid expansion type ; control knob at top of cabinet.

Supply.—Gas model : connexions 1/4-in. B.S.P. male or 1/4-in. B.S.P. female.

The supply is governed to eliminate variations in gas pressure. Gas tap in plinth base incorporates a defrost position.

Electric model : For operation on a.c. mains, 210—230 or 230—250 volts ; or on d.c. on request.

Levelling Device.—Four levelling screws are fitted to ensure correct alignment.

Frozen-food Compartment.—Three ice trays with plastic dividers (10 cubes per tray). Total ice per freezing, 18 oz. Additional space for approximately 4 lb. of frozen food ; or space for approximately 6 lb. of frozen food with ice trays removed.

Guarantee.—Cabinet and accessories (except plastic dishes) are guaranteed for one year, and the sealed cooling unit for 10 years.

External Dimensions.—Height, 46 1/2 in. ; width, 24 1/2 in. ; depth, 24 1/2 in. Depth, including door handle 26 1/2 in. Depth, including door swing, 45 1/2 in.

THE MAIN No. 22 REFRIGERATOR

R. & A. Main Ltd. have extended their range of domestic refrigerators by the introduction of an inexpensive 2.2 c.ft. absorption type model, to be known as the Main No. 22, which will be available as from March, 1959. A quality refrigerator, very reasonably priced at 43 guineas, the No. 22 has an attractive modern appearance and a compactness that makes it ideal where space is a vital consideration. Overall dimensions are 21 in. wide by 21 in. deep by 36 in. high. Being of the same height as the standard kitchen unit, and having a flat top, it can be easily and neatly incorporated into kitchen unit schemes.

With its 2.2 c.ft. capacity, and a shelf area of 5.4 sq. ft., it provides generous storage space. Conveniently positioned compartments in



Main No. 22 refrigerator.

the door take four pints of milk, half a dozen eggs, plus fats and other small packages.

The ice-making compartment—designed to make ice in room temperatures of up to 95° F. (35° C.)—is equipped with two ice trays complete with flexible plastic dividers, each tray providing 10 cubes. The



Interior view of Main No. 22 refrigerator.

compartment is fitted with a plastic lift-off door and, with the ice trays removed, it can be used to store up to 2½ lb. of frozen foods. Thermostatic control is effected by a knob,

numbered from 1 to 6, situated on the front of the plinth base panel.

Five sets of shelf runners are incorporated in the one-piece plastic liner, enabling the three full-width shelves to be positioned to accommodate packages of a wide variety of sizes. The shelves are covered in light-blue plastic, making them smooth and very quiet in use.

The Main No. 22 refrigerator is in either a white or cream finish, both with attractive embossed red trims on the door. The plastic lift-off door of the frozen food compartment is finished in light blue to match the colour of the door sealing strips, thermostat control knob, and the light blue anodised aluminium retaining bars on the door compartments. The door catch is of the positive press-button type and is smartly finished in bright chromium plate.

The sealed cooling unit is guaranteed for five years and the cabinet and accessories for one year.

The new Main No. 22 is available for operation either by a.c. or d.c. electricity, or by gas.

Brief specifications :

Refrigerating unit : Absorption type.

Temperature : Unit and cabinet designed to make ice in room temperatures up to 95° F. (35° C.).

Thermostat : Fluid expansion type.

Supply : Gas model : A constant-pressure governor is fitted. Maximum gas input is 525 B.t.u. per hour.

Electric model : Operates on a.c. or d.c. voltage ranges of 210/230 or 230/250. Maximum input 90 watts.

Levelling device : Four levelling screws are fitted.

Ice-making compartment : Two ice trays with plastic dividers (10 cubes per tray). Total ice per freezing 12 oz. Additional room for ¼ lb. frozen food ; or room for up to 2½ lb. frozen food with ice trays removed.

Guarantee : The cabinet and accessories are guaranteed for one year and the sealed cooling unit for five years.

External dimensions : Height 36 in. ; depth 21 in. ; width 21 in.

Kelvinator Ltd. announce the appointment of Mr. Geoffrey Stenning as advertising and sales promotion manager, on the retirement of Mrs.

DOMESTIC REFRIGERATION

E. A. Plummer, who completed 34 years' service with Hudson Motors Ltd. and Kelvinator Ltd. Both



Mr. G. Stenning.

companies are associated with American Motors Corporation, of Detroit.

Geoffrey Stenning left Simplex Electric Co. Ltd., where he was advertising and publicity manager of the Creda division, early in 1958, to join James Sutherland Publicity Ltd., as public relations director. Before joining Creda in 1955, he was



Mrs. E. A. Plummer.

group publicity manager of The Brush Group Ltd. He joined this company in 1952 on his return from Canada where he was associated with Avro Canada Ltd.



DOMESTIC REFRIGERATION

The Hotpoint D 50 Pacemaker (5 c.ft.) refrigerators are fitted with rollers to make them easy to move. Their large, extra-cold stainless-steel freezers keep ice cream for a week, and each has a deep, roomy chiller dish. The interior is space-planned to give maximum shelf area and storage space and the inner door panel holds butter and cheese compartments, an egg rack and a roomy bottle rack, finished with gold anodised aluminium trims. Three full-width shelves include one adjustable for large poultry and a glass shelf over a humidity compartment for salads and vegetables. Opening the door operates an automatic interior light. This model and a smaller version were introduced to the trade at the Savoy Hotel, London, last month.

NEWS FROM ENGLISH ELECTRIC

NEW SERVICE CENTRE

As a result of the big expansion in sales and service, The English Electric Company moved their service centre from Hampstead to extensive premises at Acton during the first week in February, where they will be able to extend servicing facilities over the whole of London and the south coast south of a line from Lyme Regis to the Wash. The new depot will cover over 15,000 sq. ft. of floor space, four times greater than the present depot, and house extensive appliance and television workshops, stores, administrative offices and garage. There will also be a section for "off-the-shelf" sales of spare parts for the full range of appliances. In addition to the resident technical staff, a team of service engineers will operate throughout the territory with fleets of vans fully equipped as

mobile workshops which will ensure prompt and efficient service to the customer. Facilities at the depot will include equipment to rebuild an appliance completely and for respraying, as well as a routine replacement service. Mr. E. Foster continues as depot manager, with Mr. W. E. Walmsley as service supervisor. The address is 231, The Vale, London, W.3, and the telephone number is Shepherds Bush 9311.

* * *

A new one-minute full-colour film promoting refrigeration, made by "English Electric" in association with Rank Screen Services, will be available for dealers and electricity boards from mid-February. The film may be ordered for showing at any cinema, and where bookings are made by dealers at local cinemas costs will form part of English Electric's co-operative advertising scheme, and the dealer's name and address will be shown at

the end of the film. The film stars Miss Ann Courtneidge as the housewife with a small modern kitchen and no cold storage space. While all the items of food normally in every day use are shown on the kitchen table, the persuasive voice of commentator Stephen Jack relates the benefits of domestic refrigeration. Doubt as to whether or not there is space for a refrigerator are soon dispelled when the housewife sees the smallness of the space needed for a Slim-line model. Executive in charge of "Slim-line Story" was John Joel.

* * *

One of the major prizes in a national contest celebrating Associated British Cinemas' 30th anniversary will be a range of English Electric appliances including a Slim-line refrigerator, automatic control cooker and a washing machine with immersion heater and pack-away wringer. Prizes worth over £2,000 can be won, including £450 in cash.

SHOP REFRIGERATION NEWS



BY A SPECIAL
CORRESPONDENT

DESIGNED FOR REFRIGERATED DISPLAY

Food shops are seldom designed for refrigeration. But the growing use of refrigerated display cabinets has already had an influence on the general appearance of those that have been re-equipped or newly opened. Once fitted throughout in mahogany, or in a cheaper wood finished to resemble it, the typical grocer's shop of the last 10 years has interior equipment of white-enamelled steel.

A factor contributing to the popularity of that more hygienic, non-absorbent finish for shopfittings generally has undoubtedly been the similarly finished refrigerated cabinet. It is a matter for thankfulness that there have been extremely few examples of refrigerated cabinets being faked to resemble wood, and thus made to match existing wall fixtures. If a number of the leading refrigeration firms had been misguided enough to take that backward step, the transformation of food shop design might have been retarded for a decade or longer.

But has the all-glossy-white surface throughout made the grocer's shop look too clinical? Mr. L. E. Timewell is one grocer who thinks so. For that reason, he has gone over to a medium-to-light green for all his equipment, including those parts of it that are refrigerated. But it is not

only in its colour scheme that this shop is distinctive.

It would be extremely difficult to find a more attractive example of a counter-assembly designed for refrigerated display than that which

forms the central feature of this interior. One of a small group of shops within 100 yards or so of the entrance to the airport at Southend-on-Sea, and just within the boundary of that county borough, it is the



This beautifully designed counter-run in Mr. L. E. Timewell's shop at Southend-on-Sea embodies two refrigerated display cases.



The quick-frozen food cabinet in the Southend shop.

result of the merging of two adjacent premises by the removal of the party wall.

The main service counter, which runs lengthwise to the double frontage, embodies two glass-fronted refrigerated cabinets. These are divided by a central cabinet made to house the refrigerating machinery, and they are flanked by two smaller counters used primarily for display and providing what are in effect wing units giving character and cohesion and magnetism to this five-unit assembly.

This refrigerated counter-run faces

the two entrances, and there is a cabinet for quick-frozen foods set at an angle near the window on the right-hand side. The two cabinets in the counter-run are by Prestcold, and the q.-f.f. cabinet Marco. The installation was carried out by Refrigeration (East Anglian) Ltd., Bury St. Edmunds.

Changes in Fish Shops

Looking back over a year of progress in refrigeration at retail level, I consider that it is in fishmongers' shops that that progress has been most marked.

More fishmongers have quick-frozen food cabinets. More of those who already had cabinets of the non-display type have changed to the glass-fronted models. More of them are refrigerated display in one form or another for wet fish.

It is possible to record that at least one individual fishmonger has installed an ice-making machine. MacFisheries have, of course, been using them for some time in a number of their provincial branches, where maintenance of regular deliveries of ice presents difficulties.

One example of change in methods

The q.f. cabinet in Mr. E. R. Stamp's shop at Banstead (by L. E. Clifford Ltd.) is prominently placed near the double door.



Turnover has doubled in this Banstead shop since the glass-fronted case was installed.



of refrigerated merchandising is provided by the shop of Mr. Leonard Mickleborough (trading as E. Kipping) at Broad Street, Dagenham, Essex.

The sales of quick-frozen foods in this shop have increased progressively ever since Mr. Mickleborough put his first cabinet in, little more than two years ago. Within a year, he had no fewer than five cabinets of the open-topped, non-display type, the contents of which could not be seen except at close quarters, and then only by leaning over the cabinet and looking down. A view of one of these cabinets in this Dagenham shop was published in the January, 1958, number of MODERN REFRIGERATION.

Those five cabinets have now been replaced by one of the glass-fronted display type: a 7-ft. 6-in.-long Eldwood, installed by Time Engineers Ltd., of Rainham, Essex. They have also put in a refrigerated window base held at a temperature of 36° F. and given up mainly to the display of poultry. The refrigerating machinery has been installed, respectively, beneath the window and behind the cabinet which is set at an angle across the left-hand back corner of the shop.

It is also in an Essex shop—at Barking, not far away—that the attractions of the slab displays in an open-fronted shop have been increased by a generous use of flake-ice made on the premises by a machine installed by York Shipley Ltd. Known as FlakIce, this machine takes the form of a two-tier, drum-shaped container 2 ft. 8½ in. high and 2 ft. in diameter, and is capable of producing 250 lb. of sparkling clear fragments of ice a day. Mains water is frozen on a stainless steel revolving drum, and the ice thus

formed is sliced off in thin ribbons, falling down a porcelain-enamelled chute into a bin from which it can be scooped as required.

In this shop there are no fewer than four low temperature cabinets (one Frigidaire and three Prestcold) lined up against the right-hand wall. The striped effect—another resort to colour as a change from glossy white—on the cabinet seen on the tight-hand side of the picture is produced by use of a self-adhesive plastic material known as Contact,

applied to the enamel surface.

Another interesting example of the beneficial results of a change-over from a plain open-topped type of cabinet to one with a glass front is provided by Mr. E. R. Stamp, fruiterer, of Banstead, Surrey, who has doubled his turnover since he installed a larger model with a glass front revealing a representative collection of the contents that can be seen even from outside the shop. This cabinet was made and installed by L. E. Clifford Ltd., Ewell, Surrey.

The Hedin standard range of humidity cabinets now includes a model equipped with a refrigeration plant, to enable low temperature testing to be carried out to M.o.S. and other specifications. The unit has a capacity allowing temperatures of -10° C. to be obtained in an ambient of 20° C. Automatic temperature control is provided by an adjustable thermostat. The unit is powered by an electrically-driven, hermetically-sealed compressor circulating "Freon-12" refrigerant. Refrigeration can also be arranged to provide dehumidification at ambient temperature. The internal dimensions of Hedin standard humidity cabinets range from 18 in. by 18 in. by 18 in. to 36 in. by 36 in. by 36 in. Construction is of stainless steel and aluminium with electro-plated brass fittings to eliminate the possibility of rusting. Fibreglass 2 in. thick ensures high thermal stability and

efficiency. A practically silent fan unit provides an ample air flow through the humidity chamber, giving a maximum temperature gradient of $\pm 1^\circ$ C. throughout the working space. For ease of operation all the controls are mounted on the front of the cabinet. Special attention has been given to facilitating maintenance, and all control gear, wiring and heaters are easily accessible behind removable panels. Humidity is normally produced by steam injected into the air stream near the fan and thoroughly mixed and cooled before it reaches the humidity chamber. If extended ranges of humidity or temperature are required, a comprehensive set of auxiliary equipment is available, in addition to refrigeration, including water cooling and water spray. Timers can be fitted providing automatic control at pre-determined conditions such as are required by Ministry of Supply specifications.

The Institute of Refrigeration Bulletin

Institute Headquarters: New Bridge Street House, New Bridge St., London, E.C.4 (CENTRAL 4694)

MARCH MEETING

At a meeting of the Institute to be held at 5.30 p.m. on Thursday, March 5, 1959, at the Institute of Marine Engineers, The Memorial Building, 76 Mark Lane, London, E.C.3, Ir. T. van Heile will present a paper entitled "Applications of refrigeration to horticultural produce in the Netherlands."

VICE-PRESIDENTS

At a recent meeting of the executive council Mr. C. M. Brain and Colonel H. Randal Steward, T.D., B.Sc. (ENG.), were appointed vice-presidents of the Institute.

Both Mr. Brain and Colonel Randal Steward have completed a number of terms of office as elected members of council and have taken a keen and active interest in the affairs of the Institute. Mr. Brain, who was elected a member in 1930, was chairman of the education committee for a number of years and served as chairman of the executive council from 1955 to 1958; he has been a governor of the National College for Heating, Ventilating, Refrigeration and Fan Engineering since its formation. Colonel Randal Steward has been a member since 1939; he has been chairman of the membership committee since 1948 and is the present chairman of the executive council.

TENTH INTERNATIONAL CONGRESS OF REFRIGERATION

Members are reminded that the lowest rate of registration fee for the Tenth International Congress of Refrigeration, which is to be held in Copenhagen from August 19 to 26, 1959, is applicable only up to March 31, 1959.

As members have already been informed, the council is endeavouring to make arrangements for travel and hotel facilities for those members and their families who wish to join the Institute party. Those members who intend to join the party should communicate with the secretary as soon as possible.

THE MOSCOW VISIT

(Continued from January issue)

Commission IV by J. C. FIDLER, O.B.E., B.Sc.,
Ph.D., Member

Four papers discussed the physics of cooling and freezing. Rutov (U.S.S.R.) and Tchigeov (U.S.S.R.) submitted mathematical papers on speed of cooling and of freezing foodstuffs. However, these theoretical papers were challenged in detail by Khatchaturov (U.S.S.R.) and Heiss (Germany). Khatchaturov's improved formulae are reputed to give figures within 10 per cent. of those obtained in practice with industrial fish-freezing plant.

Piskarev (U.S.S.R.) gave the results of his work on the influence of storage before freezing on the histological structure and hydrophylic properties of fish. Some of the factors governing hydrophylic properties are biochemical; this aspect was further discussed in a paper by Golovkin and collaborators (U.S.S.R.).

An important aspect of chilling or freezing of meat is the influence of the method of processing on the bacteriological status of the meat. Both Torok (Hungary), and Noskova and Peck (U.S.S.R.) dealt with this. Noskova and Peck's paper is one of a series dealing with the psychrophilic bacteria important in chilled storage.

The second aspect of the main topic was the use of antibiotics as an adjunct to refrigeration. Eight papers were submitted under this heading. Cook and Pentzer (U.S.A.) submitted an excellent summary, with a comprehensive bibliography of work in this field, relating to fruits and vegetables as well as to fish and meat. Gorbatoev described Russian work on antibiotics applied to meat and meat products, e.g. treatment has increased storage life of meat by four to five days at about 7° C. and added about 13 days to time during which meat can be kept in a wagon cooled by ice. A paper by Sarrazin and Vidal (France) dealt with poultry, and there were two papers on fish, by Dubrova *et al.* (U.S.S.R.) and Shewan and Stewart (U.K.). The latter paper presented the results of an extensive series of most carefully planned and executed experiments.

There were a number of other papers, dealing with the ethics of the use of antibiotics, with their mode of application, vitamins C and P as antioxidants, economics of freezing, and commercial freezing of fruits.

Full texts of all papers and discussion will be published as an annex of the Bulletin of the International Institute of Refrigeration.

Commission V by COLONEL H. RANDAL STEWARD,
T.D., B.Sc., Member

It had been laid down before the meeting that the main subjects for discussion were to be:—

- (1) Automatic control of refrigeration plants, in combined session with commission III.
- (2) Quick-freezing plant and processes.
- (3) Operation and construction of cold stores; cold storage guide.

(1) In the combined session with commission III, eight papers were read concerned with methods of automatic control and operation of refrigerating plant in cold stores and gave descriptions of actual applications to existing plants in the countries concerned. There was consideration of various automatic devices, safety measures, capacity control, etc. as well as different proposals as to the most satisfactory method of operation, relative merits of brine circulation or direct expansion, methods of defrosting and design of cooling coils.

The paper by Neuenschwander dealt at considerable length with automatic control both from the aspect of the control elements needed to give the control signal and as regards the methods by which the refrigerating capacity is adjusted in accordance with the signals received.

Polak's paper dealt with the control action needed when a compressor of variable capacity operates on several evaporators in parallel.

The papers by Laridan, Stradelli and Rasi discussed the problems and methods of automatic control and the relative merits of the various devices used.

Gindlin and Stewart's papers described particular installations, one in Moscow and the other in London, while Tkachev's

paper dealt with the design of the helical finned cooling coils used in the Moscow store. This type of cooling coil with "auto-circulation" was first described in a paper read to the 1955 Congress in Paris by Kobulashvili.

A visit was paid to the Moscow No. 12 cold store which has a total storage capacity of 35,000 tons. This store is built in two halves each being 1,750,000 c.ft., the first being completed in 1955 and the second in 1957. The construction is of reinforced concrete throughout with beamless ceilings and walls of prefabricated panels 6 ft. by 11 ft. manufactured and insulated on site. The reinforced concrete columns are circular using standard asbestos piping for moulds. The insulation is of "mineral cork" 8 in. thick. The complete store is surrounded by a 24 in. refrigerated air jacket cooled by direct expansion finned coils with pump circulation. This jacket intercepts all heat input and leaves the air coolers in the chambers to cope only with the produce load and heat intake from personnel, door opening, lighting, etc. The general storage temperature is 0° F. on five floors, each of six rooms, the ceiling height being 12 ft. 6 in. (Butter is held at 0° F.; all goods on adequate dunnage). Freezing tunnels for quick-freezing to -20° F. are located on the ground floor and space for eggs in the basement.

There are 17 compressors of varying sizes with automatic starting and stopping devices with low pressure control. Compressors are mainly of Czechoslovakian (SKODA) manufacture, vertical, single-stage and two-stage water cooled. Cooling water for compressors and condensers normally comes from an artesian well but a water cooling tower is available as an alternative. An interesting feature was the provision of remote visual indication of liquid level in the receivers by means of radio-active level indicators which also controlled the liquid feed by automatic operation of solenoid valves. The whole system was described in detail in Gindlin's paper.

(2) Under the general heading of quick-freezing, 12 papers were presented covering every type of freezing tunnel and conveyer system, fish freezing and storage equipment on board ship and quick-freezing of fruits and fruit pulps.

(3) On the subject of cold store construction and operation, 10 papers were presented covering various aspects. Baumgartner discussed the use of pre-stressed concrete for the construction of cold stores; Groschner described new cold store buildings in Eastern Germany, Salles discussed single-storey cold stores in France, Vidal gave the results of four years working of the fully automatic cold store at Chalons-sur-Saone which was inspected by members of commission V at the reunion in Lyons in 1957. This cold store is interesting in also providing a heat pump installation for the space heating of a factory nearby.

Two Russian papers considered the distribution of ammonia in cold stores. P. Maximov described a system of ammonia circulation without liquid pumps and considered that pumps were unnecessary in small installations. Filinov, however, considered that the liquid pump was desirable since it lends itself to a design of evaporator in which the ammonia charge is minimized.

Finally, J. B. Verlot spoke on the proposed cold storage guide which it is intended to submit in preliminary draft at the Tenth International Congress in Copenhagen this year. This is divided into five chapters as follows:—

1. Planning and construction of cold stores—edited by Tkatchev.
2. Conditions of storage of products—edited by Anquez.
3. Utilization, etc.—edited by Foulon.
4. Economics and staff—edited by Wegmann.
5. Handling of goods—edited by Baumgartner.

Visits by W. B. GOSNEY, B.Sc., Member

DURING the course of the meetings of commissions III, IV, and V of the International Institute of Refrigeration in Moscow a number of visits were arranged for the participants. These provided an opportunity to see much though not all of Russian progress in refrigeration technology and also of engineering generally. It is hoped that the following descriptions will convey some of the impressions formed.

The Refrigeration Research Institute

The Scientific Research Institute of the Refrigerating Industry

of the U.S.S.R., known for short as VNIKhI, is the central establishment for research in machine design as well as for a number of biological problems. Its director is Mr. Sh. Kobulashvili and it includes the following main divisions:—

- (1) Machine testing and development.
- (2) Small and automatic machines.
- (3) Commercial equipment.
- (4) Technical physics.
- (5) Refrigeration equipment design.
- (6) Dry-ice.
- (7) Transport.
- (8) Insulating materials.
- (9) Refrigeration technology (applications).
- (10) Quick-freezing.
- (11) Technology of fish and fish products.
- (12) Ice-cream.
- (13) Microbiology.
- (14) Measurements.
- (15) Economic research.
- (16) Library and technical information service

The staff which numbers 330 includes 185 scientists and engineers. In the course of a morning's visit it was obviously impossible to obtain more than a brief glimpse of each of the many interesting projects being carried out, but enough was seen to build up an impression of the formidable amount of refrigeration research being done.

The Scientific Research Institute of the Meat Industry

This Institute has a staff of over 200 of which about 100 are graduate scientists. The plant available includes chilling rooms, freezing rooms, bacon smoking plant, and various items of meat processing plant. An experimental meat factory for dealing with 6 tons of meat per day is at present being built. Among the subjects under study at the moment are the use of antibiotics for meat storage and the suitability of various breeds of cattle for meat production in the various regions of the U.S.S.R. It is understood that no work on irradiation of meat is being done here at present. Extensive library facilities and the services of a staff of translators are available. The library has some 70,000 volumes.

The Moscow State University

Moscow University was founded in 1755 and the older buildings are in the centre of the city. After the last war the decision was taken to erect a completely new university building on the Lenin Hills to the south of Moscow. Work was commenced in 1949 and finished in 1953, a very remarkable performance considering the size of the building. The number of day students is 16,000 and there are 6,000 who study by evening courses or by correspondence. More than half of the day students are residential.

The new building houses the faculties of mathematics, physics chemistry, biology, geography and geology. The other faculties of history, philology, philosophy, economics, law, journalism and Oriental languages are housed in the old buildings. No engineering or technological subjects are studied in the university. These are provided for at the various technical high schools.

The Moscow Compressor Factory

This factory manufactures horizontal and vertical compressors for ammonia and Refrigerants-12 and -22 up to about 1,000,000 kcal. per hr capacity. In addition it makes condensers and evaporators, steam-jet refrigerating systems and a few carbon dioxide compressors for dry-ice plants. The 2,000 employees are mostly men, though quite a number of women are employed on the same sort of jobs as men, for example, foundry work. The hours of work are 46 per week, made up of 8 each week-day and 6 on Saturdays.

The Likachev Automobile Works

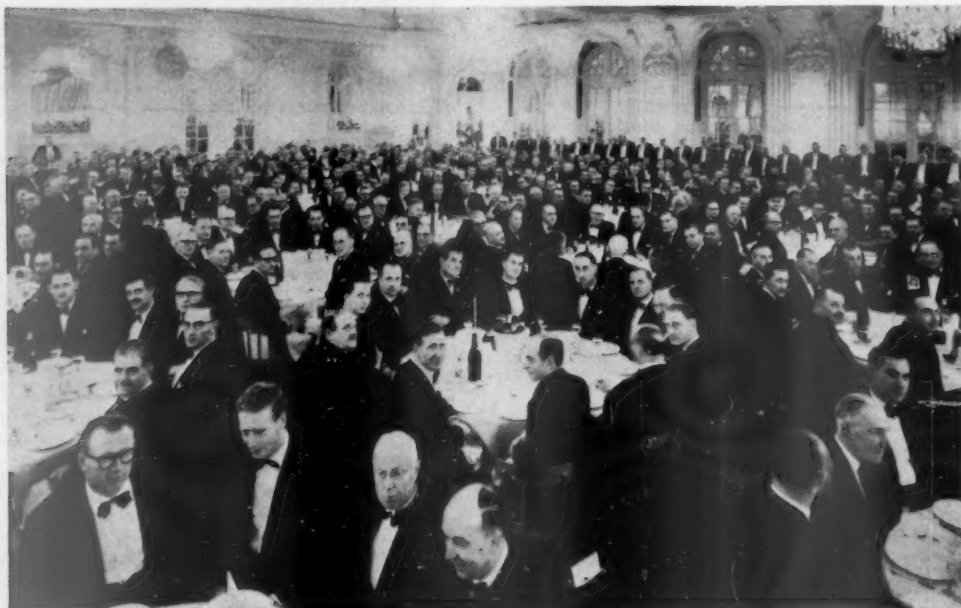
This factory produces trucks, buses and bicycles as well as the domestic refrigerators which represent a comparatively small part of its output. Of the 50,000 workers only about 530 are employed in the refrigeration section. One model only is produced known as the "Zil-Moskva" having a storage capacity of 165 litres (6 c.ft.). The refrigerating capacity of the unit is 110 kcal per hr. with Refrigerant-12. This same model

which has been in production for five years is also made by other factories. A new model of 248 litres (9 c.ft.) is now at the prototype stage and will be in production shortly. It is claimed to have a very low power consumption of 28 watts in a 20° C. ambient when the cabinet temperature is 2° C., the reason being the high efficiency which has been obtained in the electric motor through the use of special steel.

The refrigeration unit of the present model is a hermetically sealed one with capillary tube control and a roll-bonded aluminium U-type evaporator. The condenser consists of a continuous grid with vertical runs attached to a sheet which forms a chimney at the back of the cabinet. Normal voltage is 127-v. at 50 cycles per sec. The horizontal shaft compressor has a 27 mm. bore and 14 mm. stroke, with a pumping capacity on air of 46.3 litres per min. at 8 atm. pressure difference.

The Ostankino Dairy Plant

At this plant about 45 per cent. of Moscow's milk, about 540 tons per day, is handled and distributed. The milk is brought in by tankers lined with aluminium or stainless steel and insulated with cork from an average distance of 100 km. The milk is cooled on the farms and arrives at the factory at about 8° to 12° C. Some of it is pasteurised and sold as such, but an appreciable fraction is fermented to produce *kefir*, a special form of sour milk which is widely used as a breakfast drink. The fermentation is carried out in the bottle at a temperature of 18° C. for 18 hours under the action of a microfungus known as *glibok*. These bottles are distinguished by having green caps. It was interesting to see that all the bottling machines were of British manufacture, having been built by UDEC Ltd.



THE INSTITUTE'S 59th ANNUAL BANQUET

A RECORD assembly of 650 members and guests attended the 59th annual banquet at the Savoy Hotel, London, on the 28th ultimo, when Sir Rupert De la Bère, Bart, K.C.V.O., president, took the chair. Guests of the Institute were The Right Hon. The Lord Pakenham, P.C., chairman, The National Bank Ltd.; His Excellency M. Vincens de Steensen-Leth, G.C.V.O., Danish Ambassador; Air Marshal Sir R. Owen Jones, K.B.E., C.B., A.F.C., president, Institution of Mechanical Engineers; Sir William Slater, K.B.E., F.R.S., secretary, Agricultural Research Council; Major-General C. Lloyd, C.B., C.B.E., T.D., director, City and Guilds of London Institute; Vice-Admiral N. E. Dalton, C.B., O.B.E., engineer-in-chief of the Fleet; Mr. H. T. Beazley, chairman, Refrigerated Cargo Research Council; Air Vice-Marshal G. Silyn-Roberts, C.B.E., A.F.C., director-general of engineering, Air Ministry; Mr. E. P. Keely, C.B.E., Ministry of Agriculture, Fisheries and Food; Major-General H. C. Sugden, C.B.E., D.S.O., engineer-in-chief, War Office; Mr. A. A. Part, M.B.E., Ministry of Education; Mr. H. A. R. Binney, C.B., director, British Standards Institution; Mr. H. A. Secrean, C.B.E., J.P., chairman of the board of governors, National College for Heating, Ventilating, Refrigeration and Fan Engineering; Mr. E. Boden, scientific adviser to the High

Commissioner for South Africa; Dr. J. E. Garside, director, National College for Heating, Ventilating, Refrigeration and Fan Engineering; Mr. E. Ruddin, C.B.E., president, National Federation of Cold Storage and Ice Trades; Mr. E. G. Rowledge, chairman, British Refrigeration Association; Dr. E. Griffiths, O.B.E., F.R.S., president, Institut International du Froid; Mr. T. Whittaker, director, British Refrigeration Association. Supporting the president on the top table were Lieut.-Col. Lord Dudley Gordon, D.S.O., LL.D., past-president; Sir Charles G. Darwin, K.B.E., M.C., F.R.S., past-president; Mr. Kenneth Lightfoot, O.B.E., past-president; Mr. W. S. Douglas, past-president; Sir Samuel R. Beale, K.B.E., member; Col. H. Randal Steward, T.D., chairman of council; Mr. J. A. Brewster, member of council, and Mr. S. B. Turner, member of council.

Lively and witty speeches characterized the presentation of the toast list which was as follows: "The Institute of Refrigeration," proposed by The Right Hon. The Lord Pakenham, P.C., chairman of The National Bank Ltd.; response by Sir Rupert De la Bère, Bart., K.C.V.O., president of the Institute. "The Guests," proposed by Col. H. Randal Steward, T.D., chairman of council; response by His Excellency M. Vincens de Steensen-Leth, G.C.V.O., Danish Ambassador.

AT THE SAVOY

"M.R." photographs

- 1 Left to right. The Rt. Hon. The Lord Pakenham, P.C.; Sir Rupert De la Bère, Bart., K.C.V.O.; His Excellency M. Vincens de Steensen-Leth, G.C.V.O., Danish Ambassador.
- 2 Left to right. His Excellency M. Vincens de Steensen-Leth, G.C.V.O.; Mr. J. A. Brewster; Mr. E. Ruddin, C.B.E.
- 3 Left to right. Sir William Slater, K.B.E., F.R.S., and Sir Charles G. Darwin, K.B.E., M.C.

- 4 Left to right. Mr. W. S. Douglas and Mr. H. A. Secretan, C.B.E., J.P.
- 5 Left to right. Vice-Admiral N. E. Dalton, C.B., O.B.E., and Mr. S. B. Turner.
- 6 Left to right. Sir Samuel R. Beale, K.B.E., and Mr. H. A. R. Binney, C.B.
- 7 Left to right. Mr. T. Whittaker; Mr. E. G. Rowledge and Mr. Kenneth Lightfoot, O.B.E.

Top-Table Personalities



8 Left to right. Mr. L. P. Dack; Mr. S. L. N. Chandler; Mr. J. L. Murray; Mr. R. Halliday; Mr. E. H. Wood; Mr. R. Allen; Mr. J. W. Dukes.

9 Right to left. Mr. V. B. Snowdon and Mr. A. L. Bannister.

10 Left to right. Mr. J. S. Westcott; Mr. S. G. Cook; Mr. T. E. M. Douglas.

11 Left to right. Mr. R. F. Somerset; Mr. F. J. Anthony; Mr. J. Curzon; Mr. G. H. Watkins; Mr. A. E. Kittle.

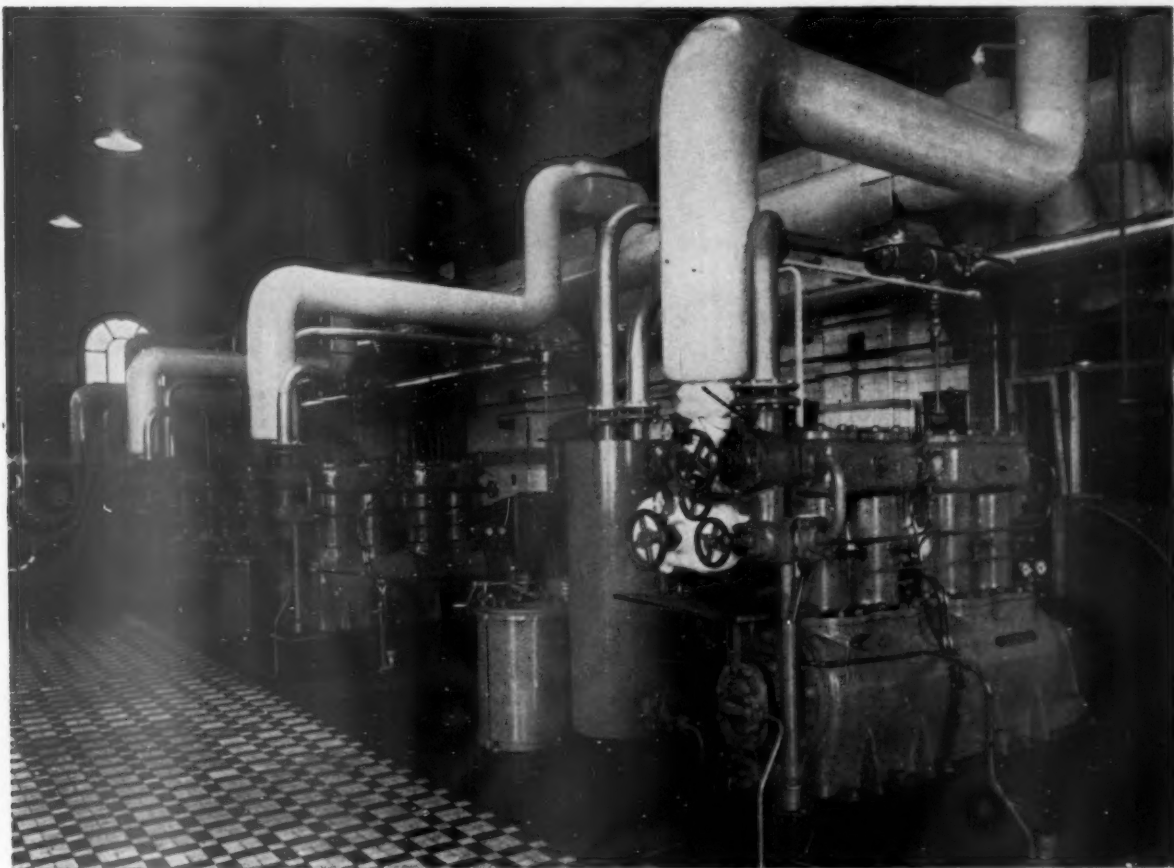
13 Left to right. Mr. G. W. Nunn; Mr. H. A. Baker; Mr. F. Fields; Mr. G. F. Eden.

14 Mainly a Sterne's group showing, third from left, rear, Mr. P. B. H. Brown; second from right, Mr. J. Douglas; left, Mr. E. R. Field; Mr. R. C. Todd; Mr. J. H. Moore; Mr. J. E. G. Miller; Mr. H. R. Scrivens; Mr. O. D. Jenkyn.

15 Left to right. Mr. A. J. Murray; Mr. P. Phillips; Mr. B. T. Smith.

16 Left to right. Mr. F. W. Oddy; Mr. H. G. Jaeger; Mr. B. H. J. Watson; Mr. H. R. Howells; Mr. E. Adkins; Mr. K. C. Hales.





Refrigeration

Refrigerating compressors of the monobloc type are widely used in the manufacture and storage of foodstuffs. This installation comprises four 8" x 8" quad and an 8" x 8" twin monobloc compressor, driven by a total of 675 h.p., and have an installed capacity of 6½ million B.t.u. per hour. It is installed at the margarine plant of the Co-operative Wholesale Society at Irlam, Manchester. The equipment manufactured by J. & E. Hall ranges from small refrigerated cabinets and compressors of ½ h.p. to centrifugal compressors of the largest size in use today.



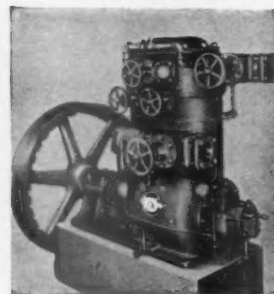
J. & E. HALL
LIMITED
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AP 203



COMMERCIAL AND INDUSTRIAL SECTION

Manufacturers' and distributors' news



Mr. H. N. Shelmerdine, who has been managing director of **Expanded Rubber Co. Ltd.** for over 20 years, retired on December 31, 1958. Mr. H. P. Goodall, director and secretary, and Mr. J. R. Swift, works director, have been appointed joint general managers from January 1, 1959. Mr. C. E. M. Coubrough, chairman of the board of directors, while remaining on the board, has resigned the chairmanship in favour of Mr. H. N. Shelmerdine.

Mr. H. E. Duggans, Far-East manager of **Hoover Ltd.**, has just returned to Britain after seven years overseas, for the most part based at Hong Kong. He is succeeded in his territory by his assistant, Mr. J. K. Young, of Singapore, although Mr. Duggans will continue to supervise his company's affairs in the Far East and will continue to make personal journeys there from time to time. Additionally, Mr. Duggans has now taken on the responsibility of supervising his company's export affairs in the British West Indies. Although Mr. Duggans found that import licence restrictions and shortage of foreign exchange are at present making efforts in some Far-Eastern markets difficult, he considers that people there are quickly emulating Western trends in domestic appliances, as well as in other things and he believes that Far-East markets have great potential for British trade. During his stay, Mr. Duggans flew about 100,000 miles every year over a wide area, visiting territories from Afghanistan to the Philippines, from India to Japan, from the great wall of China to Fiji.

Mr. R. Craig Wood has been elected a director of **Associated Electrical Industries Ltd.** Mr. Craig Wood has been managing director of **AEI-Hotpoint Ltd.** since 1956 and in this capacity he will continue to have responsibility for the domestic

appliance business of **AEI.** He is also chairman of **AEI-Gala Ltd.**, which handles the export of domestic appliances.

Jablo Plastics Industries Ltd., incorporating **Jablo Propellers Ltd.**, and **Moulded Components (Jablo) Ltd.**, announce the following changes on the board of directors: Col. H. Delacombe, O.B.E., has retired because of ill health. Mr. W. Dunn has been elected to the board. Mr. Dunn joined **Jablo Propellers Ltd.** in 1942, as chief engineer, and has been assistant to the founder and managing director, Mr. B. Joblonsky, since 1946.

At the 51st annual general meeting of **Peter Brotherhood Ltd.**, held at Winchester House, Old Broad Street, London, E.C., Mr. A. Marcus Neal, J.P., A.C.G.I., A.M.I.C.E., chairman of the company, presided. The chairman said, in part: "As I have pointed out previously, in a business of this type, manufacturing a large and varied range of engineering products, it is inevitable that although the tempo of activity may not vary greatly year by year, there may be considerable fluctuations in the amounts of work actually completed, invoiced and brought into account per year. . . . It so happens that several large contracts have been completed during the year under review and that each of the above factors has influenced the profit. It is for this reason that your board in their report announce that the profit figure is exceptional and is therefore unlikely to be repeated next year. . . . The trading profit before taxation amounts to £532,758. Of this trading profit provision for taxation absorbs no less than £292,250—a somewhat grim reminder—leaving us with a net profit for the year, available for allocation, of £240,508. . . . Looking further into the future I am pleased to report

that, although the rate of receipt of orders has lessened recently, we still have a reasonably satisfactory order book and every confidence that this will be sustained, thus ensuring continuity of work for a considerable time."

A brochure dealing with "Rock-sil" rock wool insulation products, just issued by the manufacturers **The Cape Asbestos Co. Ltd.**, concerns the material's applications in marine engineering. This beautifully produced 24-page illustrated publication gives full specification details of 11 products including the new "Rocksil" marine board designed for comfort and sound insulation on ships' sides, bulkheads, deckheads and accommodation partitions. Methods of application, illustrated with technical drawings, are recommended for cold insulation, main and auxiliary pipework, flanges and valves, fire-resisting bulkheads, engine room and boiler room casings. The first brochure in this series dealt with industrial applications of "Rocksil." The series is being designed and produced by **Woudhuysen & Co. Ltd.**

The Lightfoot Refrigeration Co. Ltd.'s Glasgow office is now situated at 286, Bath Street, C.2 (telephone Douglas 4265/6/7).

In connexion with the **Frigidaire** installation at the **Waitrose Supermarket**, Slough, described in our October issue, we now learn that although **R. E. A. Bott (Wigmore Street) Ltd.** obtained the order for the equipment and supplied it, **Fred G. Alden (Refrigeration) Ltd.**, as **Frigidaire** sales and service distributors for the area, carried out the installation.

Typical of many British firms now seizing opportunities to improve or diversify the services traditionally



Cooling off...

When it comes to lowering temperatures on the grand scale — there's nothing finer than the 'Arcton' range of chlorofluorohydrocarbon refrigerants made by I.C.I. And no wonder, for these products are manufactured to the highest standards of purity by the most modern methods. In the wide 'Arcton' range is a refrigerant ideally suitable for *your* particular use. Get in touch with us for any information you require.

'ARCTON' REFRIGERANTS

IMPERIAL CHEMICAL INDUSTRIES LIMITED, LONDON, S.W.1.

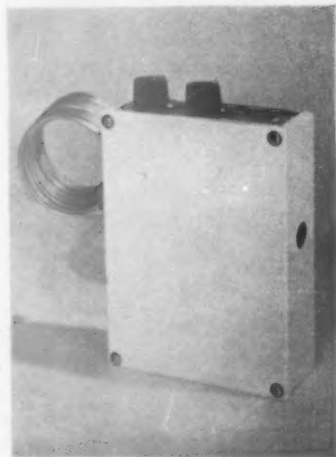


A2-43

COMMERCIAL & INDUSTRIAL

associated with their many years of existence is the **Darlaston Galvanized Holloware Co. Ltd.**, Progress Works, Holyhead Road, Wednesbury, Staffs. This firm has just installed plant capable of bonding many polythene and other types of plastic to ferrous or non-ferrous metal by the Plasinter process. The new technique which it is claimed completely overcomes peeling will have many applications in engineering, agricultural and marine industries. It is particularly suitable for wire work, tubular steel assemblies, sheet metals, aluminium ware, brackets, castings, etc. P.v.c., p.t.f.e., p.t.f.c.e. and nylon, in addition to polythene coatings, will give added strength, and resistance to chemical action. The new treatment protects the metals coated from corrosion; they are then non-toxic and the coatings themselves will withstand sterilization in boiling water. Good electrical insulation properties, reduction of noise and increased hygiene with reduced maintenance are just a few of the advantages offered.

A new dual temperature alarm has been manufactured by **Teddington Refrigeration Controls Ltd.** This



instrument has been designed to meet the demand for a compact self-contained unit giving audible alarm in the event of excessive temperature rise or fall beyond a preset setting. It has been designed primarily as a blood bank alarm to operate on rise of temperature to 42° F. and on fall

of temperature to 35° F. but the design lends itself to any other similar applications with alternative factory set alarm settings. The unit comprises basically two capillary type thermostatic switches, magnetic relay, buzzer and dry battery, all of which are neatly enclosed within an attractive white-enamelled pressed-steel case. Being battery operated it functions completely independently of mains supply and will therefore alarm at any time should mains failure result in the refrigeration unit shutting down. The battery used is one of large capacity and long storage life. Special non-corrodible contacts are fitted in both thermostatic switches to ensure that the alarm is ready for instant operation at all times. In addition to "alarm set" positions on both the thermostats, the adjustment knobs on each can be turned to an "off" position to cover shut-down or starting-up periods and an alarm test position which enables an instant check to be made at any time to ensure that the whole unit is in efficient working order. As an additional safety feature, the thermostatic switches are specially charged so that in the event of one or other of the thermal elements being damaged or capillary tubing fractured causing loss of charge, the alarm will become operative immediately.

Styrene Products Ltd. have introduced two new additions to their comprehensive range of polystyrene grades. The first grade, CP 15, is one that for some time Styrene Products Ltd. have been developing and, over a trial period, this material has been evaluated and found to be exceedingly satisfactory. It is an easy-flowing, medium impact polystyrene giving high rates of plasticisation designed specifically for all maximum production thin walled mouldings by the hot runner technique. The flow into thin sections at the low pressures possible reduces the risk of radial weakness due to orientation; it has proved to be of great value in general moulding work where higher impact strength is required than that obtained from normal general purpose moulding material. CP.30 grade is a new, extra high impact polystyrene of exceptional toughness combined with rigidity and good surface finish. It has been designed for production of high quality technical mouldings where maximum strength is required. Its development has been centred round

MODERN REFRIGERATION

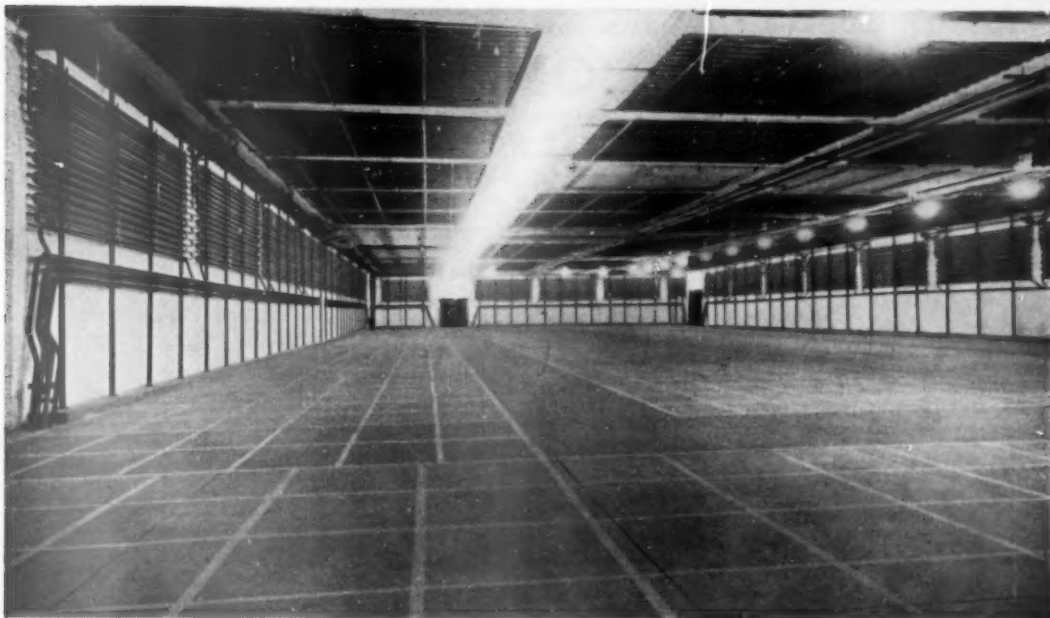
the requirements of the shoe trade and is eminently suitable for ladies' shoe heel production. It gives on heavy sections an excellent smooth homogeneous moulding, free from weld lines and is resistant to the splitting effects of the nailing operation. This grade of material is as yet only available in a natural colour but at a later date it is the intention to increase the colour range.

The Insulated Storage & Display Company have announced the new Hereford display unit. This open counter-top display is as advertised in a recent issue of **MODERN REFRIGERATION** and is available in the sizes specified at the following attractive prices: H46 (4 ft. 6 in.) model, three for £127 10s.; singles £45 each. H60 (6 ft.) model, three for £140; singles £50 each. H80 (8 ft.) model, three for £175; singles £62 each. The removable bar-type base racks finished in white plastic are available as an extra if desired. For model H45 the additional cost is £3; for model H60 £4; and for H80 £5 5s.

Mr. A. P. Marsden has been appointed traffic manager of **Union Carbide Ltd.** This department has been formed to deal with the centralization of the alloys and chemicals divisions of Union Carbide Ltd. and the present expansion plans. Mr. A. P. Marsden has for many years been actively engaged in the chemical sales division as assistant sales manager. Mr. P. W. Lucas has been appointed sales office manager of the chemicals division of Union Carbide Ltd. Mr. Lucas was formerly employed as a senior purchasing officer with **Bakelite Ltd.** in which capacity he was primarily responsible for the purchasing of imported raw materials.

A new publication, "Trichloroethylene degreasing plant type E," has been issued by **Imperial Chemical Industries Ltd.** I.C.I. has for many years been producing a standard range of open-topped metal degreasing plants operating on trichloroethylene. Ever since about 1930 the company has also produced to special order enclosed plants equipped for mechanical handling of the work during the degreasing cycle—indeed a number of plants capable of fully automatic working have been produced. The object of the new leaflet is to introduce a standard

"WIDER STILL AND WIDER-



SHALL THY BOUNDS BE SET"

In 1956 we installed the refrigerating plant for the Birds Eye frozen food store at Great Yarmouth—a single room of 250,000 cubic feet and at that time one of the largest single span storage rooms in Europe. We have just completed the installation of Birds Eye's newest store at Lowestoft—also single span, also low temperature, *BUT MORE THAN TWICE THE SIZE OF THE GREAT YARMOUTH STORE*. Over 14 miles of steel tubing, wound into grids, line the

walls and ceiling of the cold chamber and some idea of the immensity of this room can be gained from the fact that 140 London buses could be parked comfortably inside it. These are only two—even if the two largest—of more than 60 cold rooms which we have been privileged to equip for Birds Eye during the past eight years and we are proud of the knowledge that the major part of our business is made up of such repeat orders from world leaders in many industries.

People who really know and who make sure that each job is the utmost value for money come to Lightfoot-again and again

LIGHTFOOT
REFRIGERATION

ABBEYDALE ROAD, NORTH CIRCULAR ROAD, WEMBLEY, MIDDLESEX

FWS

heat-X

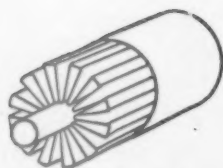
featuring the
patent
INNER FIN
construction

CONDENSERS

Shell and Tube



CAPACITIES
5 to 150 tons



INNER FIN

If you require heat transfer equipment of the shell and tube type that will give you maximum possible efficiency with minimum size and cost, you would do well to enquire now about Heat-X Inner Fin Shell and Tube Condensers; particularly about their exclusive patented, copper inner fin construction and the non-ferrous shell-side water passages which leave little danger of corrosion—advantages which ensure you long and trouble-free service from every Heat-X IC Condenser.

WRITE FOR BULLETIN HX/1002

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DUNHAM-BUSH

HEATING AND COOLING

range of totally enclosed mechanised plants. The work handling capacity of the new plants and the choice of treatments available is sufficiently flexible to enable them to deal with a wide variety of industrial metal degreasing problems. A major benefit arising from the introduction of the new range of plants is that the intricate design work entailed in preparing a plant to special order will be eliminated, thus ensuring that customers receive quicker delivery.

next highest number of points and they were awarded a Prestcold "good salesman" diploma together with a prize, whilst the third section consisted of a "beat your best" contest in which the 10 salesmen who exceeded by the highest percentage their sales during the previous competition were given recognition.

Making the presentations was Mr. E. G. Rowledge, senior director of the Prestcold Division, supported by Mr. K. J. R. Cocke, divisional



Mr. E. G. Rowledge, senior director of Prestcold (standing) welcoming the salesmen at the presentation of awards. Left to right are: Mr. E. Hall, marketing director of Birds Eye Foods; Mr. Rowledge; Mr. K. J. R. Cocke, director and general manager, Prestcold; and Mr. M. S. Ware, commercial sales manager, Prestcold.

Prestcold's Best Sellers. In mid-December a galaxy of star salesmen assembled at Prestcold's London headquarters in Regent Street for presentation of competition awards. They came from all over Britain to receive prizes which ranged from gold wrist watches and spin-dryers to flight vouchers for two and "do-it-yourself" kits.

The competition, which ran for nine months and was open to all Prestcold distributor and branch retail salesmen, had three main sections, all based on the amount of equipment sold; points being allocated according to the value and type of the items for which orders were taken. The first section was of the five salesmen who gained the highest number of points in the competition, and they were awarded a Prestcold "master salesman" diploma in addition to prizes which they were allowed to choose from a very comprehensive list. Section number two consisted of the 10 salesmen with the

director and general manager, and Mr. M. S. Ware, commercial sales manager. Very welcome and important guests were Mr. E. Hall, marketing director of Birds Eye Foods, together with Mr. K. Webb, general sales manager; Mr. P. Kemp, general advertising manager, and Mr. P. Bingham, public relations manager from the same company.

Top of the list in the "master salesman" awards was Mr. L. Barlow, of Refrigeration Services Ltd., closely followed by Messrs. W. R. Ketteridge, of Prestcold's Kent branch; N. Cutcliffe, of W. J. Allsop & Son Ltd.; H. Moseley, of E. Helliwell & Co. (Refrigeration) Ltd., and H. Travis, of W. J. Allsop & Son Ltd.

"Good salesman" awards were presented to Messrs. L. Bostock, of Refrigeration Services Ltd.; E. C. Wardrop, of Hampshire Refrigeration Ltd.; A. E. Peterson, of Refrigeration (East Anglia) Ltd.; R. Stacey, of Gardiner Sons & Co.;

COMMERCIAL & INDUSTRIAL

C. T. R. Neal, of Prestcold's Leeds branch; D. E. A. Frost, of Bedford Refrigeration Co. Ltd.; J. Stuart, of Prestcold's London office; A. F. Evans, of Prestcold's Cardiff branch; J. P. Dawson, of Hampshire Refrigeration Ltd., and J. H. Barnett, of Prestcold's Cardiff branch.

In the "beat your best" section, the highest percentage was gained by Mr. J. W. Gallacher, of Wm. Kemp & Co. (Refrigeration) Ltd. with Messrs. H. G. Pease, of Prestcold's Leeds branch; T. W. Powell, of Refrigeration (Mitton) Ltd., Newcastle; D. McPhee, of W. Kemp & Company (Refrigeration) Ltd.; J. Coutts, of the same company; J. W. Redfearn, of Prestcold's Leeds branch; A. Lamb, of Wm. Kemp & Co. (Refrigeration) Ltd.; C. Corr, of Prestcold's London office; E. Jones, of North Wales branch, and J. Lawson, of Refrigeration (Birmingham) Ltd., also gaining awards. It was noteworthy that a considerable number of entrants in this competition easily managed to top the 100 per cent. mark, which not only reflects on the quality of the product they sell but upon their considerable ability in the selling field.

After the presentations, all present went to "The Talk of the Town" for dinner and cabaret, a move which formed a fitting finish to an enjoyable and crowded evening.

The process that gives Polyflex polystyrene film and sheet its unique properties also demands careful selection of adhesives and printing inks for use with the material. **Monsanto Chemicals Ltd.** has compiled a list of adhesives and inks recommended for use with Polyflex, which the company is now marketing in this country. All inquiries should be made to Monsanto Chemicals Ltd., Monsanto House, 10-18, Victoria Street, London, S.W.1.

Chamberlain Industries Ltd., of Staffa Works, Staffa Road, Leyton, E.10, manufacturers of the "Staffa" range of tube benders and hydraulic equipment, reports that it has been appointed sole distributor throughout the United Kingdom for this Swiss-made conduit bending machine. The "Rival" conduit bending machine is a portable outfit suitable for fixing to brick piers or steel stanchions up to 12 in. deep on any bending site.

COMMERCIAL & INDUSTRIAL



An experimental extrusion of silicone rubbers in I.C.I. Research Department, Stevenston.

I.C.I. has made fast progress in silicone production in recent years. During 1958 production capacity of the I.C.I. silicone plant has been increased five-fold. To try to cap-

ture something of the atmosphere of silicone research the Nobel division asked the well-known industrial photographer, Walter Nurnberg, to visit the Ardeer factory in Ayrshire and record something of what he saw; this has been set down in an interesting brochure.

* * *

On the right is the newly-styled Simplex "Cambridge" ice bank milk cooler which is now panelled with Stelvetite, the new plastic-coated steel made by John Summers & Sons Ltd of Chester. An exhibition devoted entirely to the fabrication and



applications of Stelvetite, Britain's revolutionary new plastic-coated steel sheet, was held at the Royal Festival Hall, London, last month.

Refrigeration Servicemen's Association

NOTES FROM M. R. HADRY, SECRETARY

THE lecture at the January meeting on a subject not generally given much thought elicited much interest.

Mr. T. Bell, of The Lightfoot Refrigeration Co. Ltd., lectured on the use of the psychrometric chart for servicemen.

An explanation of the chart and its uses was followed by practical examples on the blackboard. The previous issue of charts enabled members to follow both the oral and practical



Mr. T. Bell, lecturer at the January meeting.

parts of the lecture. The greater need for use of the chart was made when the lecturer spoke of the tendency for some servicemen to consider the temperature rather than the condition of the air. By condition he meant the moisture content in relation to comfort conditions.

It was unfortunate that the various instruments used for measuring the condition and flow of air were not described in more detail but an interesting lecture had already outrun its time. To enable members to learn more about this subject, Mr. Bell has offered to give a future lecture.

Although air-conditioning is not used as extensively in this country as other methods of refrigeration, there is a steady growth and members would be well advised to take this opportunity of advancing their knowledge of this subject.

At this meeting copies of the proposed by-laws were presented to members and copies have been sent to members unable to attend. Approval to pass these by-laws will be sought by the committee at the next meeting thus giving members ample opportunity for study and suggestions. Members unable to attend this meeting should note that non-attendance will be taken as approval of the by-laws.

The acceptance of the by-laws will be an important step in the formation of the R.S.A. as a corporate body. It was also announced at the meeting that a banking account had been opened in the name of the Association.

So far the policy of the committee to give lectures covering a wide variety of subjects has proved satisfactory. The remaining lectures this session are of interest and those wishing to attend and see something of our activities are invited to the following meetings before this session is concluded :-

February 10—"Training methods for service engineers."

March 10—"Refrigeration in aircraft."

April 14—"Cooling plates."

Forms for membership are available at these meetings or by application to the secretary, 57, May Avenue, Canvey Island, Essex.

REFRIGERATED TRANSPORT

by STERNE



Photograph shows a minus 10° F. Refrigerated Vehicle with a nett capacity of 3,500 gallons of ice cream. The equipment is driven from the mains supply when in the depot and by a diesel engine when on the road. This is one of 25 refrigerated vehicles, for which the refrigerating equipment was entrusted by Messrs. Neilsons (Ice Cream and Frozen Foods) Ltd. to us in 1958. A repeat order for the equipment for a further number of vehicles is now under construction.

EQUIPMENT SUPPLIED AND INSTALLED FOR ALL TYPES OF REFRIGERATED TRANSPORT

L. STERNE & CO. LTD.

(Incorporating Haslam Foundry & Engineering Co. Ltd.)

CROWN IRON WORKS, NORTH WOODSIDE RD., GLASGOW, N.W. Douglas 6461

SALES OFFICES AND SERVICE DEPOTS:

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BRISTOL	Bristol 24038	NEWCASTLE	Newcastle 66-1048	BELFAST	Belfast 59211	DUBLIN	Dublin 71316
CARDIFF	Cardiff 26408	HULL	Hull 31198				

HYDROCOOLING *in the Spring*

AT this time of the year it is appropriate to consider the spring leaf vegetables which will shortly be in season. Marketing these vegetables can be made easier and, overall, much more profitable, by the use of hydrocooling.

This comparatively new aspect of refrigeration has already thoroughly proved its efficiency. As an example, spring cabbage cooled by this method of removing field heat immedi-

ately after harvesting, remains fresh and in good condition for much longer compared with untreated vegetables which can begin decomposition immediately after leaving the ground. Moreover, apart from lasting longer, hydrocooled vegetables are more in demand by wholesalers and retailers who appreciate their obvious quality and also by customers who appreciate that they taste better and represent better value for money since waste is almost eliminated. In addition hydrocooled produce lasts longer in cold storage.

Pioneered by Prestcold and developed by them by means of intensive study and research over a period of some five years, the hydrocooler is simplicity itself in operation. Field heat is removed by immersing crated fruit or vegetables in ice-cold

water. (These crates later make for easier handling and transportation). The produce is carried along in a bath of ice-cold water, kept moving and chilled further by directional sprays of aerated ice-cold water, a feature which Prestcold have found, by intensive research, to be essential to good hydrocooling and for which they have taken out a special patent. This also washes the produce at the same time. Water used is thoroughly screened then recirculated passing over an ice-bank below water level, to gain maximum cooling effect.

Aeration of the water has the additional advantage that the odours which tend to contaminate it are disseminated into the atmosphere by the water passing in fine sprays through the air before being cooled and re-entering the tank. Because of this it is not necessary to change the water so frequently.

Adjustable guide rails provide lanes along which the crates flow so that jamming is prevented.

Concerning the economics of hydrocooling from the grower's point of view, allowing for depreciation and running costs, a



Prestcold executives and engineers inspecting a hydrocooler on a Marlow farm; also in the picture is the agricultural correspondent of the "Daily Express" speaking to the owner of the farm.

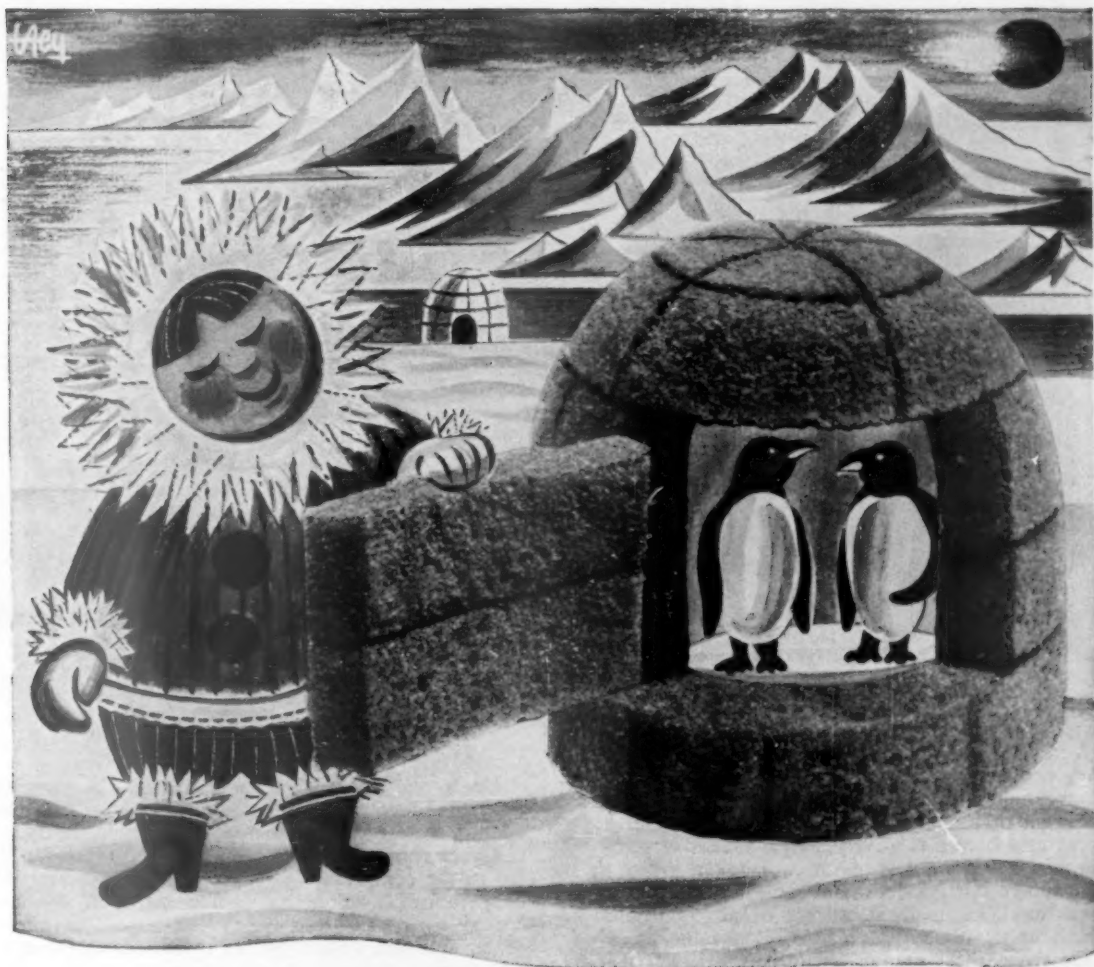
grower operating a hydrocooler costing something in the nature of £2,000 might reasonably expect his extra production costs to work out at about 3d. per crate. With a larger unit costing some £3,000, this extra would drop to about 2½d. But the extra profit* which can be gained on a crate labelled "hydrocooled" may amount to several shillings.

Running costs are kept low by spreading the operating time of the refrigerating unit over 20 to 24 hours, much of it in off-peak periods. During the day the Super-Presmetic unit provides direct refrigeration in addition to the refrigerated effect of melting ice, at night it builds up a bank of ice ready for the next day's work. Consequently a relatively small unit can cope with a surprisingly large amount of produce.

The Peruvian Government is sponsoring the first Pacific International Trade Fair which will be held at Lima from October 1 to 18, 1959. The purpose of the fair is to encourage the further industrialization of Peru and the neighbouring countries, Chile, Bolivia, Ecuador and Brazil. Special efforts will be made to attract trade buyers from South American countries. The Lima Chamber of Commerce and other industrial organizations in Peru are proposing to hold a large Latin-American convention during the period of the fair which should help to ensure the attendance at the fair of a large number of buyers from countries outside Peru. The commercial exhibits will be shown in trade sections and there will also be government displays. The Board of Trade is organizing a display which will cover about 2,000 sq. ft. and its theme will probably be how United Kingdom industry can help to develop the resources of Peru in particular and Latin-America in general.

It is hoped that United Kingdom firms will support this effort. United Kingdom firms interested in taking part in this fair should write direct to the organizers: Pacific International Trade Fair, P.O. Box 4900, Lima, Peru.

Under the International Co-operation Administration procurement for Pakistan, a window type air-conditioner is needed: 1½ ton capacity, when operating on 220-volt, 50-cycle, single phase, a.c. The air-conditioner is for use in a tropical climate with expected outdoor temperature of 120° dry bulb, relative humidity to 95 per cent., 220-volt, 50-cycle, single phase current.



new insulation, light and strong

These simple-to-mix components give rigid foams to provide the refrigeration industry with a remarkable new insulating material that combines high thermal resistance with strength and lightness. Easily mixed on the site, the components produce the foam in the cavity to be filled. Foams of varying density can easily be made.

with **Isocyanates**

and **POLYESTERS** by



Ask for details of **Daltolacs 21, 22 & 24** and **Suprasec D**.

Enquiries should be addressed to:

I.C.I. Sales Development Department (Polyisocyanates), Ship Canal House, King Street, Manchester 2.

IMPERIAL CHEMICAL INDUSTRIES LIMITED LONDON SW1 ENGLAND



The cold-air unit for the Comet 4, weighing 20 lb. and handling 80 lb. per min. of air.

Air-Conditioning Equipment developed for the New Comet

DESCRIPTION OF DE HAVILLAND PROPELLERS LTD'S MODERN PLANT*

A PART from the many structural and control problems directly associated with pressurization itself, the introduction of the pressure cabin on military and civil aircraft turned what had previously been a relatively simple matter of supplying air, more or less as it was taken from the atmosphere but possibly with some heating, into the important and involved subject of air-conditioning which exists to-day.

On the earliest pressurized military aircraft using mechanical superchargers, usually of the Roots type driven by the engine, the heat of compression was usually sufficiently small to be taken care of by a ram-cooled heat exchanger. However, the advent of the jet engine, from whose compressor air could be tapped directly for pressurization, coupled with demands for better cooling, created the need for means of cooling the air for the cabin to below atmospheric temperature. A similar need arose on civil aircraft fitted with cabin superchargers, when operating at low altitude or waiting on the runway in hot climates.

Thus the air-cycle cold-air unit came into general use and air-conditioning systems assumed a complexity which necessitated the provision of an extensive range of equipment. In addition, the ever-increasing duties which certain electrical equipment has to perform within very small space limitation has made it necessary to produce forced cooling at temperature levels frequently below atmospheric and here again the air-cycle unit has usually been employed, although refrigerants such as ammonia and "Freon" are being used in a few cases, in either closed-cycle or open-cycle systems.

Cold-Air Units

Up to the time when de Havilland entered this field the only air-cycle units manufactured in this country were of the turbo-compressor type; in these, air from the cabin blower or engine compressor is fed to the compressor of the cold-air unit where its temperature is raised by compression. It is then cooled by passing through a ram-air-cooled inter-cooler and then cooled further by expansion through the turbine mounted on the other end of the shaft carrying the compressor. This type is more usually known as a "bootstrap" unit from the impression it gives of driving itself. Its main disadvantage is that it cannot be used on the ground unless some special means is provided for inducing cooling air-flow through the intercooler and through any primary heat exchanger cooling the air entering the compressor.

By introducing the turbo-fan unit, manufactured under a licence agreement from Hamilton Standard, de Havilland were the first to make available in this country a cold-air unit specifically designed to provide cooling on the ground and therefore suited to the needs of practically all military and civil aircraft then under development. Seven different models of de Havilland turbo-fan units have been adopted for cabin or equipment cooling on current civil and military aircraft. In this type of unit the air-expansion turbine is directly coupled to a fan which, in absorbing the power derived from the turbine, can draw cooling air through a heat exchanger to lower the temperature of the air fed to

* By courtesy of de Havilland Gazette.

Alarm!



The Teddington Dual Temperature Audible Alarm originally designed for use in hospital blood banks sounds loudly in the event of any undue *rise or fall* in temperature enabling corrections to be quickly made. It can be used for any application requiring an alarm in the event of excessive temperature change. Alarm sounds in the event of a fault in the thermal system, if mains electricity fails or when desired for testing.

TEDDINGTON REFRIGERATION CONTROLS LTD • SUNBURY-ON-THAMES

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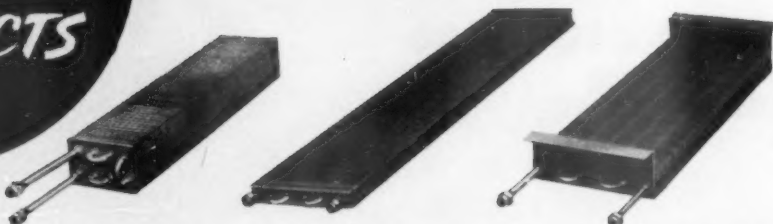
Alarm!

USE

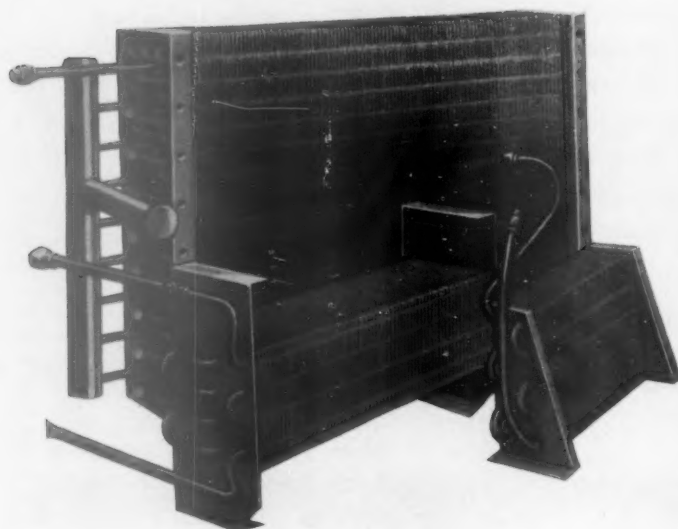


**Manufacturers of Coolers and
Condensers for Commercial,
Industrial Refrigeration and
Air-Conditioning Applications**

**FINNED COOLERS
FOR :—**



DISPLAY CASE, COMMERCIAL and INDUSTRIAL APPLICATIONS



**FINNED COOLERS
FOR AIR-CONDITIONING APPLICATIONS**

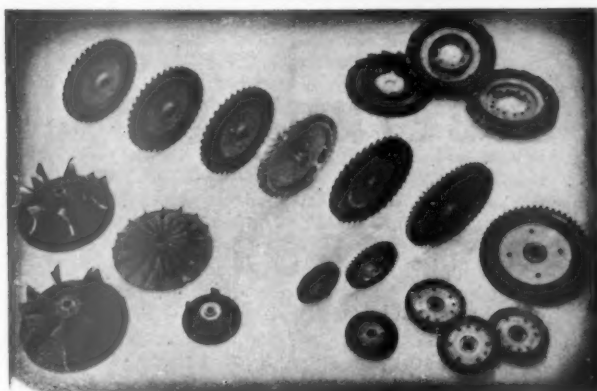


**FINNED TYPE
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Some rotors and nozzles used on de Havilland cold-air units.

the turbine (from, say, an engine compressor) under conditions when there would be no ram-air flow to provide this.

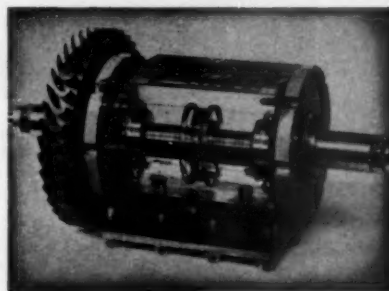
An axial flow turbine is used on all de Havilland units of this type and whilst the peak efficiency obtainable with this form of turbine is several points lower than that of inward-flow radial designs the variation of efficiency over the normal speed range is very much lower. As it is extremely difficult, if not impractical, to operate these units at exactly optimum efficiency it is generally found that, over the whole range of the more critical cooling conditions, the characteristics of the axial-flow turbine more than outweigh its somewhat lower peak efficiency. Another advantage of this design is the very low weight and small size which can be achieved without recourse to excessively high shaft speeds—for instance one unit passing 56 lb. per min. and dissipating 51 kW. weighs only 6.75 lb. and can operate at up to 72,000 r.p.m.

The range of units at present in production covers air flows from 20 lb. per min. to 80 lb. per min., the smallest weighing 6.75 lb. and the largest 21 lb. The normal maximum operating speeds for these units are respectively 66,000 r.p.m. and 35,500 r.p.m.

Due to the high rotational speeds it is essential to achieve an extremely high degree of dynamic balance in the rotative assembly. The limiting factor here is the smoothness of the bearings themselves; beyond a certain degree of balance it is not possible to separate the out-of-balance signals from those caused by minute roughness in the bearing itself; two types of dynamic balancing machine are in current use, one of American and the other of de Havilland design. The turbine rotor and fan are each individually balanced and then the complete rotative assembly is balanced, after which only the fan housing and turbine end cover have to be fitted to complete the assembly; after a functional check, known as a "green run," a balance check is made and the assembly rebalanced if necessary.

Cleanliness of the bearing assembly and good lubrication are vital for reliable operation at these high speeds, and while it is quite a straightforward

matter to ensure that bearings are handled under suitable conditions, intensive development has had to be devoted to the lubrication aspect. The bearing must be supplied with sufficient oil to carry away heat from the tracks and cage and maintain adequate lubrication of the surfaces in sliding contact. Any excess oil is liable to cause undue drag on the cage, leading to excessive wear of the ball pockets and possibly overheating of the cage and balls. The lubrication system used on earlier types of units provides a metered supply of oil to the bearings by gravity from a reservoir, the oil thrown out of the bearings being discharged finally into the fan air. On later designs oil is carried in a sump and is pumped to the bearings by means of a scroll cut in the shaft, ultimately draining back into the sump to be recirculated. Face seals are mounted at each end of the bearing assembly to prevent leakage of oil and eliminate the possibility of any flow of air through the bearings, thus providing in effect a sealed sump; even a very small influx of air is liable to carry foreign matter into bearings or interfere with the oil flow.



A rig for investigating cold-air unit lubrication systems.

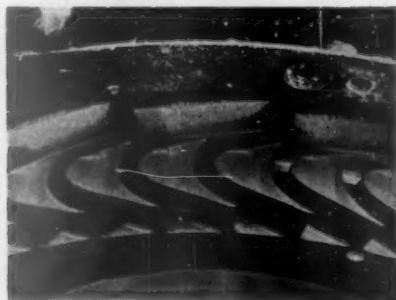
The aim has been to provide a lubrication system which requires replenishment at very infrequent intervals, ideally not at all, during the overhaul period of the unit. As a result of successful flight

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Original turbine blading showing erosion attack on the light-alloy blades.



New turbine blading, eliminating erosion, as used on production Comet units.

experience on the first military type of unit having the "sealed" system, the period between topping-up with oil has recently been raised to 250 hours and for civil units it is expected that it will be possible before long to exceed this figure by a very considerable margin.

Over a period of some 50 flying hours of the Comet 3 G—ANLO at the end of 1957, including tropical trials of the aircraft, no checking or "topping-up" of the oil system was carried out on the two de Havilland PRU 80-01 cold-air units fitted

and on these units the "topping-up" period has been raised to 100 hours.

An interesting although worrying problem on certain cold-air units having a particular type of turbine blading has been erosion of the turbine nozzle and rotor blading. It was at first thought that this erosion, which gave the blades the appearance of having been sand- or even shot-blasted, was due to steel or swarf in the air-supply ducts—as it was in one or two instances—but subsequent evidence indicated that it could also occur under conditions

where no contamination of the air supply was possible. By fitting a transparent shroud around the turbine wheel the behaviour of particles of sand, steel and water as they transversed the space between the nozzle and rotor was examined. This showed that, with the turbine blade subjected to this attack, such particles did not enter the rotor passages immediately but tended to remain between the nozzle and the rotor, and to rotate around this space with the wheel. It appeared that due to the particular combination of nozzle and turbine-blade shapes the particles were bouncing about between the stationary and moving blades many times before finally escaping through the rotor passages, thus eventually breaking down the hard anodic film on the light-alloy blades.

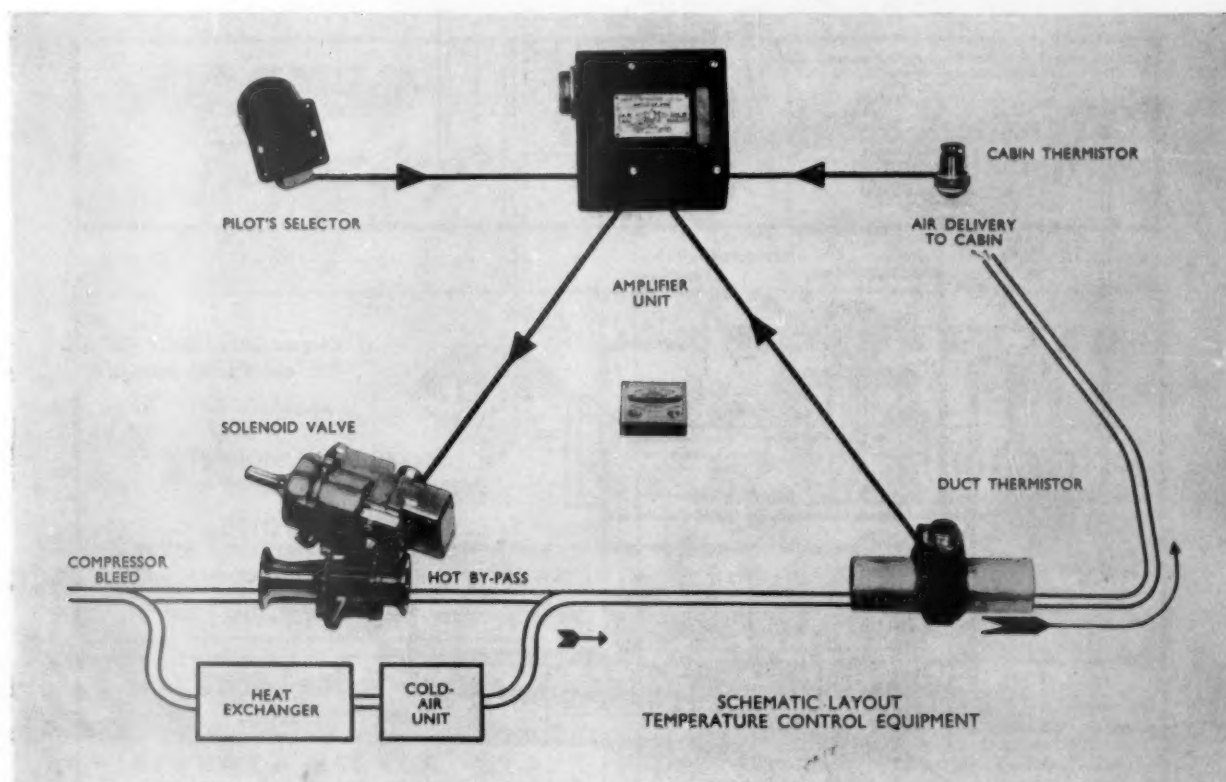
As a result of this work the turbine blading was redesigned to alter the profile adjacent to the nozzle so as to avoid as far as possible any tendency for rebound to take place. This was so successful that particles of steel swarf roughly .050 inch diameter could be injected into the turbine air supply without any marked damage occurring. Subsequent flight testing on the Comet with one unit having the new blading and another the original blading showed that the new blade form remained completely free from

erosion while the original blading suffered serious attack. Equally satisfactory experience has been obtained during several hundred hours' flying of other units having the new-design blading.

An alternative solution to the problem would have been to fit filters in the turbine-supply line, as in certain other types of unit, but these are undesirable as they penalise cooling performance due to pressure loss, are heavy and bulky and would probably require regular inspection and servicing.

The cause of erosion has not been established, although it is thought that it is possibly caused by flying through rain. During the erosion test programme it was proved that injection of quite small quantities of water into the turbine would produce erosion in a matter of minutes.

Although a cold-air unit is a relatively simple machine the performance calculations associated with it and the amount of development involved are both extensive, due to the fact that its varied operating conditions, which embrace a wide range of temperatures and pressures over the altitude and climatic range of the aircraft concerned, can have a pronounced effect on the speed at which it operates and the loads imposed on the bearings. These factors are not generally realised, but performance work on



A schematic layout for temperature-control equipment. The size of the components may be judged from the match-box.

the cold-air unit for almost any system has now become so extensive that detailed analysis within the time available is only really possible on a computer.



Conditioning package incorporating pneumatic temperature control.

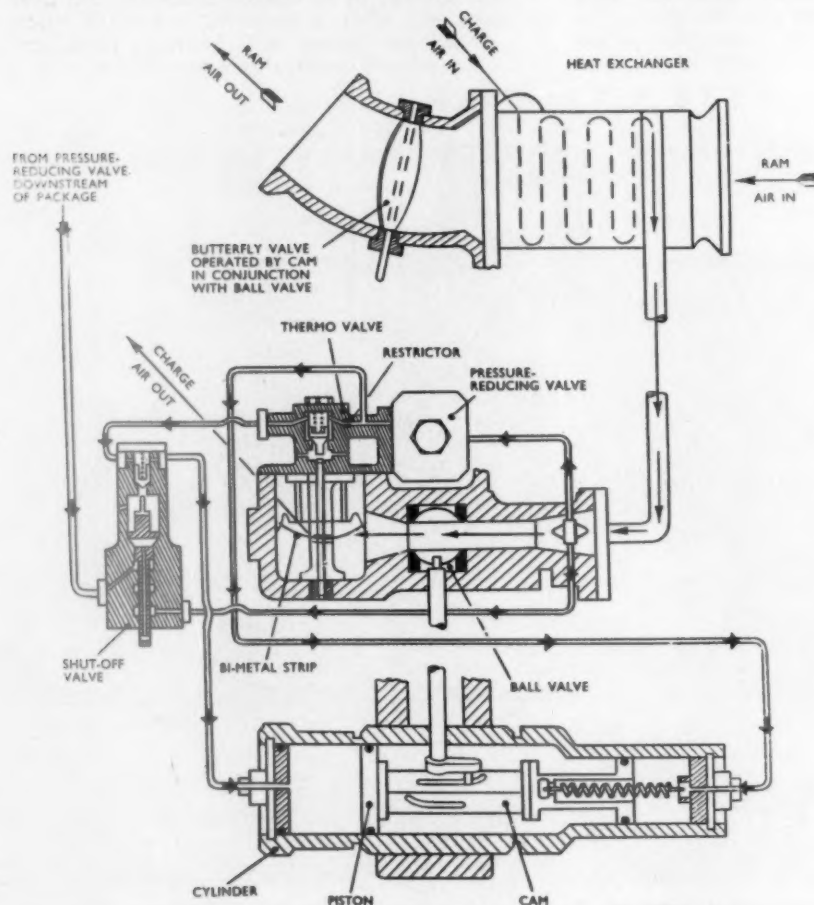
In spite of the interest shown in "Freon" equipment by various civil operators during the past two years, it is believed that air-cycle systems will prove

to be the most popular choice for civil aircraft for a number of years to come and work is proceeding on a new and original type of air-cycle which will enable the limitations in the performance of present air-cycle systems to be eliminated.

Vapour-cycle Refrigeration Units

Following an extensive study of certain applications for this type of cooling unit, de Havilland Propellers Ltd. have now entered this field with a two-cylinder compressor directly coupled to a hydraulic swash-plate motor operating at speeds up to 7,000 r.p.m., providing up to 7 kW. (2 tons) of cooling at the design conditions. The motor is a slightly modified version of the one already developed for an aircraft alternator power unit and operates at a constant swash-plate angle. The compressor is a two-cylinder unit of fairly conventional layout and is designed to eliminate any possibility of oil leaking into it from the hydraulic motor.

It is designed to operate on "Isceon-122," "Freon-12" or "Arcton-6" at pressures up to 275 p.s.i. and to give its rated cooling output of 7 kW. at a



Diagrammatic layout of air-conditioning package.

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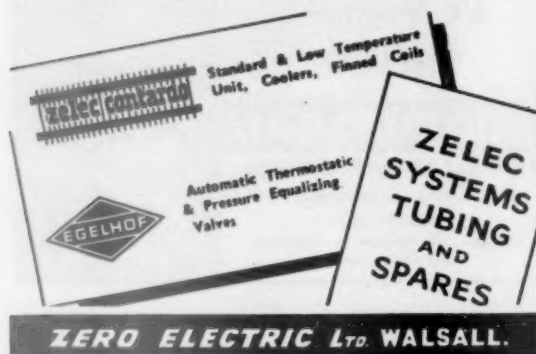
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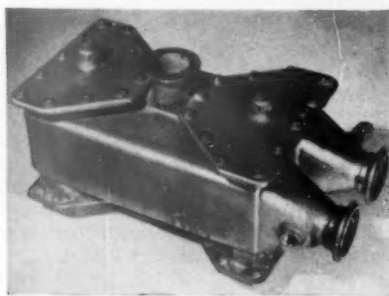
ENGINEERS

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condenser temperature of 60° C. and an evaporator temperature of 2° C. It is controlled to this figure to prevent icing (when cooling moist air) by regulating the compressor speed and hence evaporator pressure.

The compressor speed is regulated by means of a flow controller which senses evaporator absolute pressure and adjusts the position of a rotary throttle valve in the oil supply line to the motor to hold this pressure to its required value. A superheater is included in the system to ensure that only dry vapour is drawn into the compressor as wet vapour can be detrimental.

One application for this equipment is for cooling and dehumidifying the air supply for ventilated suits.



Experimental fully-aerobatic water boiler for high-speed aircraft.

The air is first cooled down to 2° C. to extract as much moisture as possible and is then reheated to the required temperature by means of a small heat exchanger through which engine-bleed air is passed, the rate of flow of this air being controlled by a pneumatic valve responding to a thermostatic unit located in the suit air duct.

Air-ventilated Suit System

The introduction of the air-ventilated suit on fighter and bomber aircraft to ensure that their crews are kept reasonably comfortable under certain extreme conditions, such as when the cabin-air conditioning system is inoperative, has created new problems and the need for further special equipment. de Havilland Propellers are now developing for one of the V-bombers a packaged unit comprising heat exchanger, air-cycle cold-air unit, electronic temperature control, water extractor and emergency system incorporating pneumatic temperature control. The pack is fed with bleed air from the engine compressors and a proportion of this air is delivered to the suits after reducing its temperature to the required level and extracting moisture to meet the stringent low humidity requirements for suit air. The remainder of the air is expanded through the cold-air unit to cool the suit air and is then discharged to atmosphere.

The temperature control equipment is basically the same as that already developed for cabin

temperature control and comprises a temperature selector (situated in the cabin), electronic amplifier, duct stats (temperature sensing elements) and an electro-pneumatic actuator operating two valves in sequence, one valve being in the turbine inlet line and the other at the outlet from the fan of the cold-air unit. On some aircraft there is an additional cooling stage upstream of the package and this involves a third valve which operates in sequence with the two on the pack itself, in response to signals from the same amplifier system.

The method of moisture extraction used on this pack is unique for aircraft air-conditioning systems but is extremely simple. The water is "squeezed" out of the air by bringing it into contact with a cold surface under pressure. Very high extraction efficiencies have been achieved with this method and, furthermore, at sub-zero cold-air unit discharge temperatures no serious build-up of ice or snow occurs in the cooling passages of the extractor.

Manual temperature selection is provided and safety over-rides are incorporated to guard against dangerously high temperatures due to failure of the control valves or cold-air unit.

Temperature Control Equipment

Both electro-pneumatic and fully pneumatic temperature controls have been developed, but the latter have so far only been used where a fixed temperature is required, such as for equipment cooling and certain ventilated-suit systems. The former lends itself to a much easier installation, is generally more suitable where the selector is remote from the central



Cold-air unit handling 56 lb. per min. of air for a weight of 6.75 lb.

system and, due largely to the use of a pneumatic actuator, its weight is lower than that of a fully pneumatic system.

The electro-pneumatic system comprises a pneumatic actuator, usually operating a butterfly or ball-valve, an electronic or magnetic amplifier, duct stat, cabin stat and temperature selector. The duct stat serves the dual purpose of stabilizing the system and

prevents the duct temperatures from exceeding predetermined limits.

The electro-pneumatic actuator is controlled by means of a proportional solenoid which regulates air pressure in the actuator cylinder according to the signal from the amplifier, the servo air supply being taken from the air inlet to the valve or from an independent source. Automatic control operates on a 115-volt 400-cycle single-phase supply, with a maximum demand of 6VA, whilst manual control is by 28 volt D.C. with a maximum loading of 2.5W.

The temperature-sensing elements in the duct and cabin stats take the form of thermistors hermetically sealed and mounted to have optimum thermal and mechanical properties. For automatic control of cabin temperature the resistance of the cabin thermistor is compared in a D.C. bridge circuit with a resistance chosen on the selector switch. This switch has 28 step positions divided into two equal sectors, one for manual and one for automatic control. Each step on automatic control is equal to approximately 2° C. change in selected cabin temperature, low position corresponding to a selected temperature of about 0° C. and the high position corresponding to a selected temperature of about 33° C. Rotation of the switch clockwise results in a decrease in resistance in one arm of the bridge circuit which will rebalance when the increase in cabin temperature causes the cabin stat to decrease in resistance, the thermistor having a high negative temperature/resistance coefficient.

The unbalance in the bridge circuit, due to error between selected and actual cabin temperature, serves to vary the current in the output valve of a two-stage direct-current coupled-amplifier. The solenoid winding forms the anode load of this output valve. Thus any temperature error results in the opening or closing of the butterfly valve in such a way as to eliminate the error.

The solenoid winding has a resistance of approxi-

mately 2,000 ohm, and requires a maximum of .3W. for operation, maximum current corresponding to the "fully open" position of the butterfly valve.

Negative feedback, in the form of varying spring pressure applied to the solenoid armature, is employed to achieve proportionality between solenoid current and valve opening.

Two duct thermistors may be employed, mounted in a common assembly, primarily to limit delivery air temperature within a predetermined band (-5° C. to +100° C.). In this instance, it is sufficient for the thermistor elements to form part of a divider chain across the high-tension rails of the amplifier unit (+150 V. D.C.). Normally, in the over-ride portion of the circuit, the voltage appearing across the thermistor is clamped and has no effect upon the normal functioning of the system. However, if the delivery air temperature departs from the predetermined band, the voltage developed across, say, the upper-limit thermistor, is arranged to commence reducing anode current in the second stage, thus decreasing delivery air temperature, by closing the butterfly valve. The reverse action will occur if delivery air temperature falls below the lower limit, this being sensed by the other thermistor element.

By means of suitable capacitive networks, the rate of change of voltage appearing across one of the duct thermistor elements is utilized as negative feedback, thus serving to stabilize the overall system and suppress any hunting which would otherwise occur.

For direct electrical control of the butterfly valve, the pilot's selector switch is operated from the mid position to full anti-clockwise. In this instance again, fourteen positions are provided, the mid position corresponding to fully closed or "LOW" and the extreme anti-clock corresponding to fully open or "HIGH" temperature.

The current activities of de Havilland Propellers Ltd. embrace all forms of air-conditioning, cooling and pressure control.

In our recent description of the Smithfield Show, London, we mentioned that a "Bedford Self-serva" was on display on the Prestcold stand. These cases are, in fact, marketed under the name of "Selserva" and they are produced by the Bedford Refrigeration Co. Ltd., of Windsor Road, Bedford.

New Companies

The accompanying particulars of New Companies recently registered are taken from the Daily Register compiled by Messrs. Jordan and Sons Ltd.

Insulfix Ltd., 18/20, High Street, Watford. To carry on the business of the supply installation and fixing of thermal insulation of buildings, etc. Capital: £100. Harry Pebody, Milton, Northampton, signs as director. Solicitors: Phipps and Troup Northampton. Registered by Jordan & Sons, Ltd.

Refrigeration Sales & Rentals Ltd., Ellerslie Chambers, Hinton Road, Bournemouth. Secretary: H. A. C. Luckham, Capital: £100. Directors: Tom R. Jenkins, Kerrington, Lawrence Drive, Canford Cliffs, Poole, Dorset; Henry A. C.

Luckham, 4, Blake Hill Crescent, Parkstone. Solicitors: Chas. G. Lester & Co., Bournemouth. Registered by Solicitors' Law Stationery Society, Ltd.

Langley Insulation Ltd. To carry on business of importers, exporters, designers, manufacturers of and dealers in insulating materials, electric and mechanical articles, etc. Capital: £100. Directors: not named. Subscribers: H. A. Southwell and E. J. Libby, 7 Arundel Street, W.C.2 (Clerks). Registered by Solicitors: Reynolds Gorst and Porter, W.C.2.

Melling Insulation Co. Ltd., Office 22, 66, Hanover Street, Liverpool. Secretary: W. D. S. Dunn. Capital: £1,000. Directors: John E. Fitzpatrick, 19, Ingleborough Road, Birkenhead. Registered by Business Economy Products, Ltd.

Sweetnam & Bradley Ltd., Bremilham Works, Bristol Road, Malmesbury. Secretary: A. C. E. Bradley. To carry on business of electrical engineers, general electrical and refrigeration contractors, etc. Nominal capital: £6,600. Directors: James D. Sweetnam, Cowbridge Hill, Malmesbury; Arthur C. E. Bradley, 12, Bristol Street, Malmesbury. Solicitors: Clark and Smith, Malmesbury. Registered by Solicitors' Law Stationery Society, Ltd.

North West Surrey Meat Traders Ltd., Onslow Bridge Chambers, Bridge Street, Guildford, Surrey. Secretary: Reginald D. Crosswell. Nominal Capital: £2,000. Directors: Francis A. Brookes, 65 Hollies / venue, West Byfleet; Geo.

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E. Coyne, 4, Rapley Close, Old Dean Estate, Camberley; Harry T. Cranford, Mrs. Alice W. Hatto, Owen E. Moore and Harry Prosser. Registered by Shaw and Blake, Ltd.

Iford Asbestos & Insulation Co. Ltd., 17, Tavistock Gardens, Ilford, Essex. To carry on business of insulating contractors, etc. Nominal Capital: £200. Permanent directors: Leslie S. Ainsworth and Beatrice R. Ainsworth, 17, Tavistock Gardens, Ilford, Essex.

Birch, Metcalf (Distributors) Ltd., 85/7, Wembley Hill Road, Wembley, Middlesex. To carry on business of manufacturers of and dealers in stoves, ranges, heating, ventilating and refrigerating plant, etc. Nominal Capital: £100. Directors: Mark W. Metcalf, 18, Draycot Road, Wanstead, E.1 (co. dir.); Wm. G. Birch, 55, Runnymede Road, Greenford, Middlesex (co. dir.). Registered by Solicitors' Law Stationery Society, Ltd.

Davis Refrigeration Co. Ltd., 218, Chorley New Road, Horwich, nr. Bolton, Lancs. Secretary: R. Davis. Nominal Capital: £100. To carry on business of Manufacturers of and dealers in refrigerators, etc. Directors: Ronald Davis, 5, East Road, Manchester, 12; Thomas Barnes, 41, Bashall Street, Bolton. Registered by Jordan & Sons, Ltd.

Iccold Foods & Refrigeration Ltd., 31, Wallasey Road, Wallasey, Ches. Secretary: Nellie C. A. McGibbon. Nominal Capital: £100. Directors: John A. McGibbon and Nellie C. A. McGibbon, 22, Marine Park Mansions, New Brighton, Wallasey, Ches.; Charles Bower, 100, Earlstown Road, Wallasey, Ches. Registered by Business Economy Products, Ltd.

Jackson Refrigeration Ltd., 20, Bridge Street, Wrexham. Secretary: K. Wynn. Capital £10,000. Directors: Frank A. W. Jackson and Edith E. Jackson, 47, Percy Road, Wrexham. Solicitors: Cyril Jones, Son and Williams, Wrexham. Registered by Solicitors' Law Stationery Society, Ltd.

Bar Equipment & Refrigeration Co. Ltd. The Old Roller Mill, South Darenth. Secretary: S. G. Overy. Capital: £100. Directors: Stephen G. Overy, "Westwood," Prescott Avenue, Longfield, Kent; Lawrence Kiernan, 116, King Henry Road, N.W.3; John W. Corbett, The Old Roller Mill, South Darenth. Registered by Shaw & Blake, Ltd.

John Whittome & Co. Ltd., 5, Court Road, Bridgend. Secretary: R. T. K. Powell. To carry on business of heating ventilating, refrigerating and air-conditioning engineers, electrical engineers, etc. Capital: £100. Directors: John W. Whittome, 64, Victoria Road, Port Talbot; Richard T. K. Powell, 115, Oaklands Road, Bridgend. Solicitors: Randall, Llewellyn & Co. Registered by Solicitors' Law Stationery Society Ltd.

Frozenaire Ltd., "The Beeches," Old Catton, Norwich. Secretary: J. J. Miller. To carry on business of designers, manufacturers of and dealers in cabinets for refrigerators and electrical appliances, etc. Capital £100. Directors: John J. Miller (ch) and Mrs. Jean D. Miller, "The Beeches," Old Catton, Norwich. Solicitors: Clapham and Summers, Norwich. Registered by Jordan & Sons, Ltd.

Grecon Systems Ltd. To carry on business of manufacturers and installers of and dealers in insulating materials, etc. Capital: £100. Director: not named. Subscribers: S. E. Reeder and Herbert C. Davies, 11 Old Jewry, E. C.2. (Solicitors). Registered by Solicitors: Clifford-Turner & Co., E.C.2.

Paxman Cooler Manufacturing Co. Ltd., 34, Little Horton Lane, Bradford, 5. Secretary: G. Doughty. To carry on business of manufacturers of refrigeration equipment, coolers and display cabinets, etc. Capital: £10,000. Directors: Eric R. Paxman and Bessie A. Paxman, 15, Mayfield Avenue, Bailiff Bridge, Brighouse; Colin M. R. Wilkinson, "Far Oaks," Birch Lane, Bradford, 5. Registered by Hutton Hartley & Co. Ltd.

Fairways Insulation Co. Ltd. To carry on business of manufacturers of and dealers in refrigerators and cold storage machinery, etc. Capital: £3,000. Directors: Gerald E. Fawke, Hamilton Cottage, Chilston Road, Tunbridge Wells; James Strettle, Tudor Dene, Church Lane, East Peckham, Kent; Leslie A. Fawke, Lucas Grange, Haywards Heath, Sussex. Registered by solicitors: Leslie A. Fawke, W.1.

Birmingham Air Treatment Ltd., 44, High Street, Erdington, Birmingham, 23. Secretary: Barbara K. Tremayne. To carry on business of electrical, mechanical, chemical, heating and ventilating engineers, etc. Capital: £200. Director:

John F. Tremayne, 5, Somerville Road, Sutton Coldfield. Solicitors: Eddowes, Perry and Osbourne, Erdington. Registered by solicitors' Law Stationery Society, Ltd.

E. L. Schioler & Co. Ltd., 34, The Crescent, Leatherhead. Secretary: E. C. L. Schioler. To carry on business of manufacturers of and dealers in and workers in insulating materials for providing insulation at both high and low temperatures to buildings, etc. Capital: £5,000. Directors: Eiler T. L. Schioler, 5, Coldharbour Lane, Dorking; Edgar L. Crane, Carmen, Longfield Road, Dorking; Mrs. V. U. L. Schioler and Eiler C. L. Schioler. Registered by Solicitors: Lindsay Greenfield and Turner, Leatherhead.

Homes Insulation Ltd. To carry on business of builders, heating insulation and ventilation engineers, etc. Capital: £100. Subscribers: J. Kennedy, 25, Hillgate Street, W.8 (solicitor); J. F. Monk, 3, Finch Lane, E.C.3 (solicitor). Registered by solicitor: J. M. Kennedy, 25, Hillgate Street, W.8.

Trembath & Co. (Sales) Ltd., Purley Way, Croydon, Surrey. Secretary: C. H. Fisher. To carry on business of refrigeration and electrical engineers, etc. Capital: £2,000. Directors: Norman L. Trembath, 93, Sandy Lane, Cheam, Surrey; Arthur G. Elliott, 69, York Road, Belmont, Sutton, Surrey; Mrs. Barbara M. Trembath and Albert T. Ireland. Registered by solicitors: Tulk and Mann, Leatherhead.

G. R. Woodgar (Refrigeration) Ltd., 87-9 Baker Street, W.1. Secretary: B. J. Berman. Nominal capital: £4,000. Directors: Geoffrey R. Woolgar and Audrey M. Woolgar, Farleigh House, Kingston Hill, Surrey. Registered by Business Economy Products Ltd.

Air-Right Ltd., 158, Upper New Walk, Leicester. To carry on business of air-conditioning engineers, etc. Nominal capital: £100. Directors: not named. Subscribers: Mrs. Gwendolen M. Corby, 110, Hopefield Road, Leicester; Mrs. Nancy J. Commander, 37, Hidcote Road, Oadby, Leicester. Solicitors: Wright and Freeman, Leicester. Registered by Solicitors' Law Stationery Society Ltd.

Refrigeration Patents

These new refrigerating patents have been specially selected for readers by MODERN REFRIGERATION from the Official *Journal of Patents*, and are published by permission of the Controller of H.M. Stationery Office.

APPLICATIONS RECEIVED

December 5—Pressed Steel Co. Ltd., Green, D. W., P39236, Refrigerating system; Pressed Steel Co. Ltd., Thomas G., P39237, Refrigerators. 8—Dunham-Bush, Ltd., C39451, Temperature control system. 9—General Electric Co., Ltd., Hilbourne, R. A., P39665, Temperature controlling apparatus. 11—Robertshaw-Fulton Controls Co., C40024, Temperature controlling system. 12—General Electric Co., C40140, Cooling system. 15—Licentia Patent-Verwaltungs G.m.b.H., C40319, Refrigerators evaporator.

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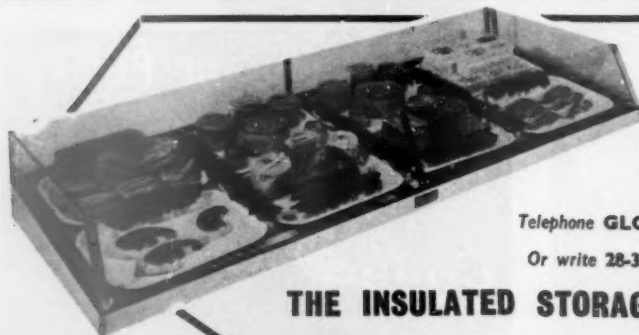
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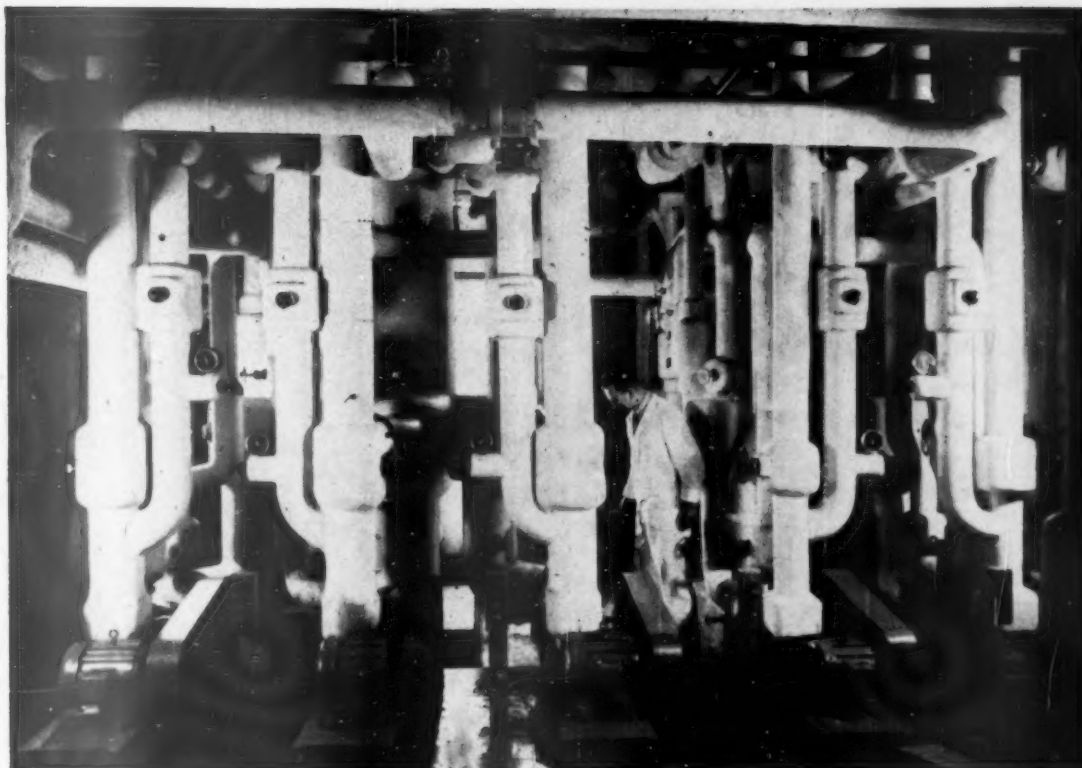
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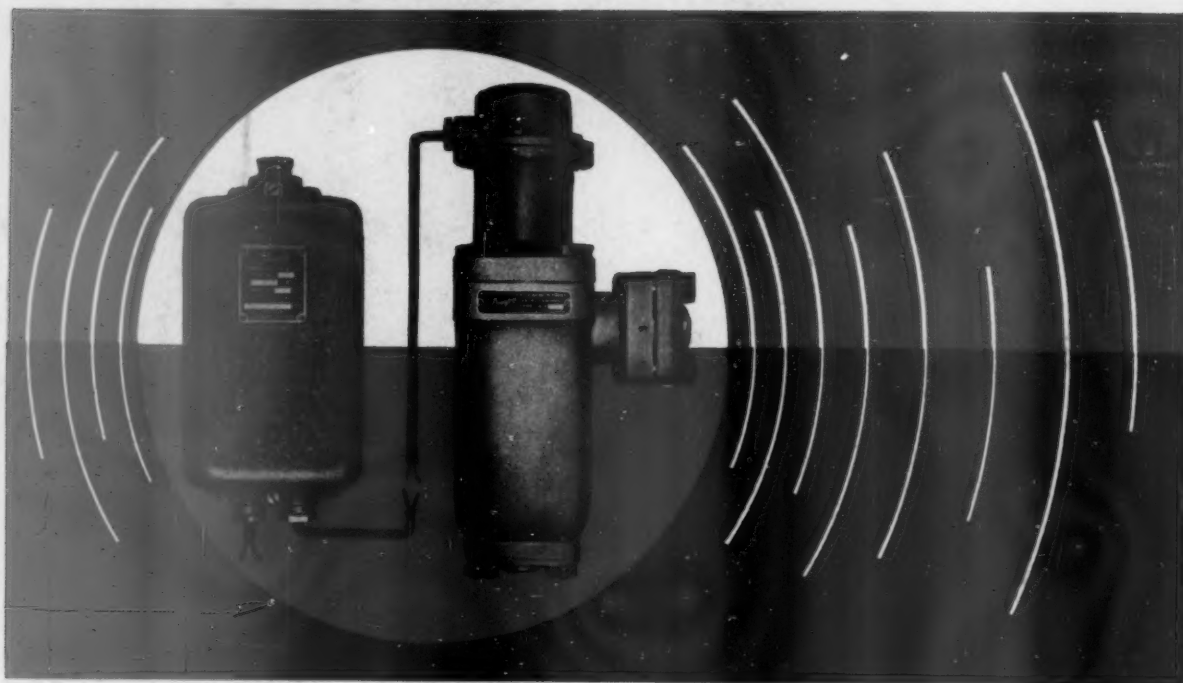
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